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Leadership in Industry

THE wide attention now being given to training for management in industry is indicated by the discussion in Section F (Economics) of the British Association at the recent Blackpool meeting on the subject. This interest finds ample justification in a pregnant passage in the introduction to the recent annual report of the Industrial Health Research Board. The aim of the research work directed by the Board is to advance knowledge which may be used in the prevention of industrial misfits, the complex causes of which offer a wide field for investigation. While many factors enter into industrial fitness, advancing knowledge now offers the prospect of being able to lay down, though not rigidly, reasonable physical and mental standards for various occupations which should ensure for the operative entering industry a greater chance of maintaining good health, in the broadest sense of the word, during his working life.

Given, however, the best conditions of work and the most carefully selected body of employees, the final responsibility for the maintenance of health and contentment lies with the supervising staff. Accordingly, the greatest practical contribution of vocational tests to industry would be proof of their value in selecting such staff, from foremen to managers.

Scientific and technical matters are nevertheless not the only factors which increase the onus and responsibilities of management. The very demand of industry for alert, smart, active men, rather than men of brawn and muscle, brings fresh problems. While such men are more adaptable to the needs of modern industry, they are also more responsive to variations in their environment, more aggressive, quicker to make trouble, and to demand their rights, as well as more liable to forget their duties. Thus, as the Report points out, the modern manager of a labour force must be awake to the changes, physical and mental, which are taking place. He can no longer be a dictator or afford to be tactless.

Many of the investigations of the Industrial Health Research Board point to the conclusion that selection and training are especially needed for management. Corroborative evidence is provided by those passages of the recent report of H.M. Chief Inspector of Factories, in which reference is made to the opportunity of improvement in regard to the prevention of accidents in the education of the smaller and often non-associated employers.

The rising accident incidence rates among young workers affords another illustration of the extent to which scientific management has still to make its influence felt in industry. Similarly, the existence of gross overwork reported under hours of employment further indicates the many problems, such as the extension of the five-day week or the two-shift system, which call for scientific assistance both in the investigation and in the application of the results obtained.

If the importance of training for management is now fully realized in many quarters, the practical question of how such training is to be given is far from being solved, as the discussion at Blackpool referred to above clearly showed. Already academic courses of study are prolonged, and with their crowded time-tables tend to inculcate ready-made ideas without sufficient stress being laid upon a general background of fundamental natural laws, so that the average student readily loses his sense of individuality and the desire for original thought.

Merely to add a further course of lectures or classes to an overcrowded syllabus is unlikely to assist either the undergraduate or the young graduate to qualify for positions of responsibility in which clarity of judgment, a sense of values, and a knowledge of fundamental principles are among the first qualifications demanded.

In a valuable paper on accident prevention in industry, contributed to the Chemical Engineering Congress of the World Power Conference last July, Messrs. C. S. Robinson and H. R. Payne pointed out, for example, that most young technical men take up their first post in a works without having heard of accident prevention during their academic careers. Accordingly, in their keenness on their work they were liable, through inexperience, to endanger at first the safety traditions which their employers had been at pains to establish. Messrs. Robinson and Payne suggest accordingly that there is scope for the inclusion of accident principles in the training given to men destined for executive work in manufacturing industries.

This, of course, is not to suggest that training in accident prevention should be included in the curriculum of the university or technical college. It is rather a definite plea for closely thought out plans of training for all those entering the management or executive side of industry. The most important contribution which the university could make in this field is probably that of stripping its courses of study so that they stimulate originality and initiative. If, by divesting the syllabuses of much of their minutiæ, concentrating on the fundamental principles and leaving the student adequate time to think for himself, the university can supply recruits for industry who are characterized less by knowledge of unassimilated facts than by their grasp of principles, freshness of outlook and capacity for independent and critical thought, the most important first step in training for management will have been taken.

From such recruits, the training courses which many industries normally give will enable the more promising material to be sifted readily, while the general standard of assimilation and adjustment to the industry's requirements will be considerably raised. The question of further training and selection remains. Whether it is best to recruit a specially selected small group of individuals, providing them with special opportunities for acquiring experience, and promoting them rapidly as occasion offers to the higher administrative posts, is at least debatable. Frequently administrative ability, even of the highest order, develops only with experience, and accordingly it is of advantage to select staff for training for promotion to the highest positions of management not from the recruits entering the organization, but from those of a few years' service, whose record indicates sufficient promise.

For such promising employees some firms have used the Department of Business Administration at the London School of Economics as a kind of staff college, to give them a wider view of their work. The combination of training of this type, either external or, with the larger firms, internal, with the provision of special opportunities for acquiring experience for those whose ability has been further demonstrated in the training course, appears to offer special promise. There still remains, however, the necessity for the chief executives of the firm to devote their own time to the training of those destined to occupy the higher positions, and upon the quality and thoroughness of this training at present as much depends as on anything else.

The problem is, in fact, only partly that of recruiting the right type of material and providing the promising recruit with opportunities for sufficiently rapid promotion. It is also that of securing in the organization the tradition and atmosphere in which efficient management is possible. The highest possible type of recruit will prove largely ineffective if sound principles of business management are continually being violated in the organization, whether on the plea of privilege or expediency or anything else. Indifference to such matters undermines the efficiency of many firms to-day, and is a fatal obstacle in building for to-morrow an alert and efficient management competent to assess the many intricate factors involved, and to meet with knowledge and resource the ever-changing conditions of industry.

For this reason, the continued penetration of the professional spirit in the sphere of management, with its sense of social and professional responsibility and insistence on the linking of action to facts, is highly important. Even yet the lessons of the industrial revolution of the last century and more are largely unlearnt, and machinery tends to be our master and not our servant. Only as something of the scientific spirit takes charge, seeking to develop methods which eliminate the loss and inefficiency in the sphere of human or social relations and distribution,

which have so far largely annulled or even outweighed the advantages which have come from the greater mechanical efficiency of power production and modern machinery, can we hope for the evolution of organization in which the machine is assimilated to human purposes.

The management of to-morrow cannot be content to think of efficiency in terms of mechanical and physical production alone. As Sir Josiah Stamp's presidential address at Blackpool suggests, it must take account of the direct and indirect consequences of mass production, monotony of work, nervous tension, leading to mechanization of mind and diminished creative power. In the narrowest sense, industrial efficiency cannot long be maintained at a high mechanical level if the social efficiency of the worker or consumer is low. Here, as much as in the field of distribution, are questions calling for close investigation if we are to evolve an industrial and social order in which the possibilities of higher standards of living now within our reach through power production are really utilized.

The fundamental demand, therefore, in industry as elsewhere, is for those who can bring to these problems of administration minds not only capable of grasping all the relevant facts and assessing values accurately, sympathetically and impartially, but also imaginatively alive to the future possibilities and free from the bondage of past traditions, whether in the economic or any other sphere. No less in the industrial than in the political world the creative mind is required, ready to adventure and experiment in a scientific spirit, unhampered by outworn conventions and traditional practices.

The Early Cultures of China

The Birth of China:
a Survey of the Formative Period of Chinese Civilization. By Herrlee Glessner Creel. Pp. 396+16 plates. (London: Jonathan Cape, Ltd., 1936.) 15*s*. net.

IT may seem remarkable that the Chinese with their passion for 'antiques' should have neglected their antiquities. The reason is not far to seek. Their intense interest in the past has been æsthetic and ethical, rather than archæological: chefs d'œuvre of art and literary sources, especially those of a philosophical cast or concerned with great personalities, exclusively absorbed their attention. In this we should be the last to blame them, for the history of study of the past in China runs closely parallel with that of similar studies in Britain. When once the researches of foreign scholars and students of geology, palæontology and anthropology had laid open other fields to their interest, the national pride in Chinese culture turned to research and exploration in the field. Since 1927, the National Institute of Research in History and Philology has pursued a policy of conservation and investigation, of which the remarkable results achieved recently in Chinese pre-history and history are presented in Dr. Creel's "The Birth of China".

In 1921 Dr. J. Gunnar Andersson, then attached to the Chinese Geological Survey, began an archæological exploration of northern China, which has now produced evidence of a neolithic culture on a large number of sites. One of the earliest and most interesting results to emerge was the existence there of a painted pottery of the highest quality, comparable to the painted pottery which had been found in western Asia, now known to be characteristic of a chalcolithic civilization and to extend from southern Russia to northern China. Further research, as yet, has by no means solved the problem of the relation of the Chinese neolithic culture with the West, nor has its internal development been fully demonstrated. The finds hitherto are regarded as late; but of these, what is apparently the earliest phase is characterized by a greyish coarse ware, which is followed by the culture of the painted pottery, presumably intrusive, but with a local centre of diffusion in north-west China. The painted pottery in its turn is followed by a 'black pottery culture', of which the first indication was found in Shantung in 1930 and 1931. Certain elements peculiar to China, and appearing more or less constantly throughout the neolithic, point to a certain continuity of culture, but the 'black pottery culture' introduces elements which are new to China, while its resemblances to later developments, notably in pottery technique, make it something of a connecting link between the earlier neolithic and the succeeding bronze age cultures.

Archæologists in Europe have had little opportunity of studying in detail the great development in the study of the civilization of the bronze age which has followed on the excavations of the National Institute of Research since 1928 at Anyang in northern Honan, North China. Indeed, the

most remarkable of the results from this site, from which Dr. Creel derives a great part of his account of the civilization of the Shang dynasty in the work under notice, was obtained only in the excavations of the season 1934–35, which closed in June 1935. A great deal of this material is still unpublished, and detailed accounts of the previous excavations are available only in Chinese. Dr. Creel, who has inspected all the archæological sites of China and has made a close study of all the 'finds', has in preparation a detailed account and discussion of the evidence. In the meantime, his present summary is the only first-hand account of the material available, in part, even for those who may have access to the reports in Chinese.

Before systematic excavation was undertaken at Anyang by the Chinese authorities, at first in conjunction with the Freer Gallery of Art of Washington, D.C., it was not entirely unsuspected that the Chinese had attained a high degree of culture in the bronze age. Antiquities, mostly bronzes, for which a high antiquity was claimed, were of comparatively frequent occurrence in the 'curio' market; but in view of the complete lack of information as to the conditions of discovery, their archæological value, as evidence, was small. The authenticity of many was questioned, not least, perhaps, on account of the advanced character of their technique. When, however, a primitive form of Chinese script was recognized in 1899 in the engravings on ancient bones which, like the fossil tooth which led ultimately to the discovery of Peking man, were exposed for sale in a chemist's shop as "dragons' bones" to be used as medicine, it became apparent after prolonged study of these inscriptions that the bones had been used for divinatory purposes and were part of royal archives, in which were mentioned rulers of the Shang dynasty, dating in the Chinese reckoning from 1765 B.C. to 1122 B.C.

It thus became evident that a basis of archæological fact had been provided for part, at least, of Chinese records hitherto regarded outside Chinese circles as legendary. Fifteen thousand inscriptions in this early script, out of more than a hundred thousand known, have now been published in facsimile. They have afforded a wealth of information relating to early Chinese language, system of writing, religious belief and social organization, as well as on the history of the Shang dynasty and its relations with neighbouring peoples. A great part of the material evidence relating to this period, the choice pieces, in fact, was the loot from grave robberies at Anyang, and it was not until the excavations of 1934–35 that comparative material, accurately dated in the archæological sense, was available to establish its chronological position and evidential value. It is now known to go back not earlier than about the fourteenth century B.C.

In 1934 the Chinese authorities, following up the investigations of previous seasons, embarked on scientific excavation at Anyang on an extended scale, a large burial ground being examined. Some three hundred graves were opened, four of them being royal tombs of a vast size. The evidence obtained is of extraordinary importance and throws a flood of light on early Chinese material culture. Some scores of ritual bronze vessels were found, of which the technical excellence in metal work is nowhere surpassed. Of special importance to the anthropologist is the evidence of the physical characters of the early peoples of China, of which nothing was known previously. The skeletal remains of eleven hundred individuals were recovered, some of them in an excellent state of preservation. The greater part of this evidence was obtained from undisturbed ground and is, archæologically, accurately datable. One of the most surprising finds was an unsuspected art of sculpture in stone, of which a number of examples of high artistic merit were found.

In describing the civilization of China under the Shang dynasty, Dr. Creel has told only half his story. In 1122 B.C., the Shangs fell before the attacks of the Chou, a confederacy of peoples from the Wei valley to the west, of whom some had been described in Shang records previously as captives, slaves and tributaries. It is probable that in comparison with the highly civilized Shang people, they really merited the title of 'barbarian'; but apparently they readily adopted Shang culture, though, as the archæological evidence shows, with certain differences. If, however, they could then add little to the material culture of China, intellectual development and growth in social and political organization under the Chou dynasty was enormous. It was in this period that China attained what was to prove its highest development in literature and philosophy, and it was under the Chou that, after a period of feudalism, the Chinese were first consolidated in the sixth century B.C. into an empire, in which political administration and influence had been transferred to the scholarly class, and principles of government were laid down which not only endured, but also served to preserve Chinese culture continuously for more than two thousand years. It is the story of this period which Dr. Creel tells in the second half of his book, reinterpreting the evidence relating to this second great phase in the birth of China in relation to its archæology, in a reconstruction in which the Chinese so-called historical literature is regarded as an ideal picture rather than as a statement of fact.

The Parsons Steam Turbine

The Development of the Parsons Steam Turbine Part 1: Turbo-Generating Machinery; Part 2: Industrial Turbo-Machinery. By R. H. Parsons. Pp. viii + 420 + 96 plates. (London: Constable and Co., Ltd., 1936.) 42*s*. net.

IT has often been remarked that the invention and the development of the steam turbine have brought about a revolution in the generation of power both ashore and afloat. That revolution was entirely unforeseen, and when Sir Charles Parsons in 1884 took out his first patents and constructed the historic little turbo-generator now preserved in the Science Museum, South Kensington, there were few who recognized the significance of the invention and none but Parsons himself who dreamt of the changes it was destined to bring about. The ideas involved were so novel, the difficulties to be overcome so great and the problems to be solved so numerous that it can now create no surprise that only the inventor himself and one or two associated with him were prepared to harness their fortunes to the turbine.

However, though its early years were very anxious ones, the turbine slowly gained a place for itself as a prime mover of singular adaptability, and with the opening of the present century began that wonderful series of advances which has led to the steam turbine being without a rival for driving large electric generators and for propelling fast vessels. Parsons was thirty years old when he took out his first patents, and for the remaining forty-six years of his life, although he had many other interests, he was associated with every fresh advance and, as Sir Alfred Ewing said, was "the active and incessant *deus ex machina*". Others, too, made their contributions towards the progress of the turbine, but Parsons was ever in the forefront in all that concerned the design, manufacture, application and operation of turbine machinery. It was said in 1920, when he was awarded the Franklin Medal of the Franklin Institute of Philadelphia, that "it is no exaggeration to say that the work of Sir Charles Parsons has halved the cost of producing electric power and reduced in still greater proportion the capital cost of generating machinery". If that was true in 1920, it was still truer in 1931 when he died.

The early history of the turbine was dealt with by the late Sir Alexander Richardson in his excellent work "The Evolution of the Parsons Steam Turbine", published in 1911, at which time the finest turbines were to be found in battleships and liners such as the *Dreadnought* and *Mauretania*. The publication of this work has been followed by numerous papers read to technical societies and articles printed in technical journals, and now Mr. R. H. Parsons in this valuable volume on the development of the Parsons steam turbine has given a most able review of the history of the steam turbine as used in power stations, factories, works and mines during the past half-century.

It is explained in the preface that the contents of the book first appeared in a series of articles in the *Engineer* in 1934 and 1935, and that these articles described in chronological order most of the outstanding machines of their day. When they appeared, the articles were regarded as a notable addition to engineering history, and republished in book form they will be much more readily accessible for study and reference.

About two-thirds of the book is devoted to turbo-generators. Beginning with the early machines, Mr. Parsons deals in turn with radial flow turbines, parallel-flow turbines, single cylinder, two cylinder and tandem machines, and concludes with post-War developments and representative modern designs. There are numerous photographs and line drawings, particulars of tests and much interesting information on the design of the various details of both turbines and generators.

The story begins with the 7 kw. machine of 1884 and ends with the 50,000 kw. machines at Dunston and Chicago. Many of our finest power stations have been erected in the last ten years and therefore have but a short history, but there are others which have been supplied with turbines of various sizes over a period of thirty years. One of these is the Derby Power Station, and when describing the 20,000 kw. turbo-generator supplied to this station in 1928, Mr. Parsons gives a table showing particulars of twelve machines supplied between 1903 and 1928. This table is accompanied by curves illustrating the successive reduction in heat consumption and the improvement in thermal efficiency. The first machine at Derby, a 350 kw. direct current generator, had a heat consumption per kilowatt of more than 25,000 B.Th.U., while the corresponding figure for the 1928 machine was 11,710 B.Th.U.

From the first, Sir Charles Parsons saw that the turbine could be applied to marine propulsion and to various industrial purposes. With the second of these, Mr. Parsons treats in the latter part of his book, where he describes and illustrates turbine-driven pumps, blowers, compressors and the like.

Seen as a whole, the history of the steam turbine is a remarkable record of the result of inventive ingenuity combined with scientific investigation devoted to the solution of an urgent, practical problem. To some extent it has features in common with the history of the Watt engine. But whereas Watt worked at a time when mechanical engineering was in its infancy, Parsons began life when machine tools, workshop processes and steam machinery had reached a high stage of development. The difficulties Watt had to contend with were, in the circumstances, greater even than those Parsons had to face, but the histories of their respective inventions will ever remain as monuments to human genius.

Developments in Industrial Chemistry

(1) Sulfuric Acid Manufacture

By Andrew M. Fairlie. (American Chemical Society Monograph Series, No. 69.) Pp. 669. (New York: Reinhold Publishing Corporation; London: Chapman and Hall, Ltd., 1936.) 48*s*. 6*d*. net.

(2) Cours de chimie industrielle

Par Prof. G. Dupont. Tome 1: Généralités, les combustibles. Pp. vi+184. 35 francs. Tome 2: Les industries minérales. Pp. iv+337. 55 francs. (Paris: Gauthier-Villars, 1936.)

(1) ALTHOUGH the United States has for many years been the chief sulphuric acid-producing country in the world yet, curiously, its technical experts have, hitherto, omitted to make any notable contribution to the standard works dealing with the manufacture of this commodity. The advent of this monograph not only repairs this omission but also gives a welcome insight into the recent developments which have taken place in America.

The author has not intended to cover his subject exhaustively but has confined himself to a thorough treatment of the present-day manufacture of sulphuric acid. Although the work deals principally with American practice, nevertheless full descriptions are given, and adequate tribute is paid, in those cases where European methods differ from, or have advanced further than, those in the United States. Such differences are mainly to be found in those nitration processes which employ either the more intensive and space-saving chambers of the Mills-Packard and Gaillard-Parrish types or use towers instead of chambers.

In describing both the nitration and contact processes, the author first deals in detail with each step of the manufacture; these steps are then linked up and the working of the plant as a whole is discussed, together with the precautions to be observed when commencing operations, and the control which is necessary in order to secure maximum efficiency.

Considerable space is devoted to a thorough examination of the contact process, and the principal types of plant are illustrated from descriptions of actual installations. The various kinds of catalysts are set forth and their preparation given whenever this is known; there is also a highly interesting discussion on the advantages and disadvantages of platinum and vanadium catalysts.

Other sections deal with the concentration of sulphuric acid, the manufacture of oleum, hazards and safety measures, the shipping of acid and a system of cost accounting. The author also gives his opinion regarding the choice of process and the trend of future developments in the industry.

The book is profusely illustrated with photographs and diagrams, while a number of graphs and tables make it even more valuable to those actually engaged in the manufacture of sulphuric acid.

(2) These volumes represent part of a course given to students in the Faculty of Science at the University of Bordeaux, and in them the author has aimed at providing a link between pure and applied chemistry by endeavouring to show how the facts and theories of the former have been utilized industrially. Although such a course must of necessity deal comparatively briefly with the numerous industries described, yet Prof. Dupont has succeeded in including most of the recent developments. The work is thus admirably adapted to those embarking on a career either as technical chemists or chemical engineers, while it is also of value to anyone wishing to obtain a concise review of modern chemical manufacture.

The first volume is divided into two sections, the first of which deals with French company and patent laws and the administration and planning of factories; descriptions are also given of representative types of plant employed. The second part, which occupies about two thirds of the book, is given over to a wonderfully concise

yet comprehensive study of natural and artificial fuels. Here are described the gas, tar-distilling and petroleum-refining industries, together with various kinds of producers and furnaces. The theoretical treatment is very thorough.

In the second volume are set forth the different inorganic chemical industries. The author first describes the liquefaction of air, the separation of its components and their uses, the production of oxygen, ozone and inorganic peroxides. The numerous processes for the preparation of industrial hydrogen are then discussed, while a subsection is devoted to the purification of water. The three following chapters, which deal respectively with the industries derived from nitrogen, sulphur and common salt, are probably the most important in this volume, covering as they do the bulk of the heavy chemical manufacture. They are excellently written, being models of terse description, although the theoretical considerations underlying the different processes receive adequate treatment. The remaining sections deal with fertilizers, with cements and with the glass and ceramic industries.

In view of the utility of these two volumes, it is a pity that they are but indifferently bound in paper covers and have uncut pages. Apart from the question of durability, even a mere chemist takes pleasure in the appearance of his library, and likes sometimes to say with Samuel Pepys, "My book is brought home handsomely bound, to my full content". G. R. D.

General Smuts

General Smuts
By Sarah Gertrude Millin. Vol. 1. Pp. xv + 394 + 12 plates. Vol. 2. Pp. xi + 496 + 11 plates. (London: Faber and Faber, Ltd., 1936.) 18*s.* net each.

FEW careers provide such a romantic story as that of General Smuts, and a biographer could scarcely fail to give a fascinating narrative from such a wealth of material. Yet with a man so versatile and manysided as General Smuts, that very wealth of material may prove the biographer's undoing, and while the scientific worker will appreciate the picture Mrs. Millin gives of the statesman, he can scarcely fail to lay down these volumes with a feeling of disappointment that so little justice has been done to the philosopher. One searches these volumes in vain for any comment upon the selection of General Smuts by the British Association to fill the office of president in its centenary year, and the philosophical views which Smuts has expounded under the name of holism receive scanty treatment.

Here as elsewhere Mrs. Millin fails in her interpretation, and gives rather a series of brilliant snapshots than the intimate and discerning study for which one had hoped. The book undoubtedly gives an arresting picture of the soldier and statesman, but Mrs. Millin's opinions are scarcely held sufficiently in check and at times she seems to lack the essential sympathy with her subject. Nor does she show full appreciation of some of the most significant of his contributions in the field of statesmanship. Only the briefest quotation is given from his outstanding Sidgwick Memorial Lecture on "Democracy" in which probably even more than in his later rectorial address on "Freedom" at St. Andrews, General Smuts gave the fullest expression to his political thought and his vision of the way in which the scientific and technical expert might be associated with the task of government in a democracy. That conception may well prove to be one of Smuts's outstanding contributions to political thought if civilization proves able to weather the storms which immediately beset it. So, too, one might have expected a more generous account of Smuts's share in the shaping of the League Covenant and of the mandates article in particular, of his views on native policy and the relations between black and white races in Africa and of the contribution of science in the administration of the backward races.

The scientific worker cannot but regret that so little justice has been done to Smuts's constructive thought in such matters. None the less, he will appreciate to the full the moving picture which Mrs. Mullin has given us of one who throughout his varied experiences has brought steadily to bear on life a spirit of adventure, of willingness to face change, to abide by the results of scientific inquiry —a genuine capacity to see life steadily and to see it whole. These are of the spirit of science, and no one can lay aside the book without reflecting that in a like union of character and the capacity for generous co-operation and scientific insight may well lie our hope of leadership adequate to save the world from the dictatorships which threaten its noblest heritage of liberty and culture.

R. BRIGHTMAN.

An Illustrated Manual of Pacific Coast Trees

By Prof. Howard E. McMinn and Evelyn Maino. With List of Trees recommended for various uses on the Pacific Coast, by Prof. H. W. Shepherd. Pp. xii+409. (Berkeley, Calif.: University of California Press; London: Cambridge University Press, 1935.) 16*s*. net.

Of the numerous works dealing with trees and shrubs, there are few of pocket size which cater specially for the needs of the amateur botanist and garden enthusiast. Prof. McMinn's small manual is to be welcomed accordingly. Though intended primarily for use on the pacific seaboard of North America from British Columbia southward, the inclusion of a large number of cultivated trees will extend its sphere of usefulness. It will not, however, be of special value in Great Britain.

Artificial keys are used for distinguishing both genera and species. The generic key makes almost exclusive use of vegetative characters, and is simple and easy to use. Characters of the reproductive parts are employed more often for identifying the species. The keys are generally accurate, but exception must be taken to the separation of the English elm from the slippery elm by the presence of corky wings on the branches. It is curious indeed if the somewhat rare corky-barked variety of the British *Ulmus procera* Salisb. should be the common type in cultivation west of the Rockies. The ambiguous name *U. campestris* L. is adopted for this species, with *U. procera* Salisb. bracketed as a synonym. A number of similar errors are caused by following the list of "Standardised Plant Names" of the American Joint Committee on Horticultural Nomenclature. To the fault of the same authority is due the decapitalization without exception of all specific names.

The book is liberally illustrated with original line drawings of leaves, fruits and flowers, which supplement the short descriptions in the text. The marginal veinlets are frequently drawn in the leaves with great care, although no use is made of vein characters for diagnosis. A further interesting feature is an appendix of twenty-nine pages. This gives lists of trees suitable for particular purposes and adapted for growth in a variety of soil types from dune sand to alkali soils.

Les races humaines

Par P. Lester et Prof. J. Millot. (Collection Armand Colin: Section de biologie, No. 192.) Pp. 223. (Paris: Armand Colin, 1936.) 10.50 francs.

Repercussions of political events have brought about a general stocktaking in racial studies, of which the most important result has been that it has constrained anthropologists to clarify and restate their views on the definition of race, the essential qualities, or characters, on which racial classification is based, and on the classification of existing races. Numerous manuals have appeared with the object of removing misapprehensions among the general public as to the character and implications of the term, when used in the strict and only sense which can be regarded as applicable to *Homo sapiens* according to his physical characters.

Among such manuals a high place can be assigned to "Les Races Humaines" by MM. Lester and Millot. It is eminently sane and well-balanced; and it has the advantage for the layman that it does not confine itself to anatomical characters. By its treatment of the racial aspect of physiological studies, in such matters as growth, the blood-groups, metabolism, the nervous system and a number of related subjects of investigation, it indicates that racial studies cover an extremely wide and varied group of phenomena, which, as yet, affords little ground for confident generalization.

Here the view of the authors, put briefly, is that 'race' is not stable, and that as a basis of classification of the varieties of man, it has, so far as our present knowledge goes, little more than methodological validity.

Textbook of Quantitative Analysis

By Prof. William Thomas Hall. Second edition. Pp. ix+350. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1935.) 15*s*. net.

Prof. Hall's book, which is divided into two parts, provides a course of elementary quantitative analysis and a course of analyses of technical products corresponding with works laboratory practice. In both parts it is marked by careful description and emphasis on points which usually give trouble to students. A large amount of very sensible practical advice is given without running into the fault of some American practical books of labouring the obvious.

The theory is equally satisfactory; as examples, the discussions on *p*H values and indicators, on oxidation and reduction, and on the theory of electrolytic separations may be mentioned. The descriptions of the manipulations give all the necessary details, so that the student using the book should be able to make good progress without too much personal attention from the demonstrator. The reasonable price of the book is deserving of mention.

Distillation

By Prof. Joseph Reilly. (Methuen's Monographs on Chemical Subjects.) Pp. viii+120. (London: Methuen and Co., Ltd., 1936.) 3*s*. 6*d*. net.

The book under notice contains a mathematical account of the theory of distillation, the theory of fractionating columns, and a discussion of the apparatus and methods involved in distillation, both laboratory and industrial. The section on low-pressure distillation is of particular interest, since some modern industrial processes, such as the purification of vitamins, depend upon this process. The separation of liquids by the principle of azeotropic mixtures is dealt with fairly fully, especially as it concerns the dehydration of alcohol, which is becoming important with the use of 99–100 per cent alcohol for motor fuel.

There are also sections on destructive distillation and on sublimation. The book is well illustrated and gives a competent survey of the modern processes of distillation.

Natural Selection and Evolutionary Progress*

By Dr. J. S. Huxley

Multiformity of Evolution

THE students of a particular aspect of evolution are prone to think that their conclusions are generally applicable, whereas they usually are not. The palæontologists unearth long evolutionary series and claim that evolution is always gradual. However, their conclusions apply almost entirely to abundant and mostly to marine animals. In some land plants, on the contrary, we now have evidence of a wholly different method of evolution —namely, the discontinuous and abrupt formation of new species. In rare forms the course of evolution will not run in the same way as in abundant and dominant types.

Meanwhile the naturalist and the comparative physiologist are struck by the adaptive characters of animals and plants: to them the problem of evolution becomes synonymous with the problem of the origin of adaptation. The systematist, on the other hand, is struck by the apparent uselessness of the characters on which he distinguishes species and genera.

The palæontologist, confronted with his continuous and long-range trends, is prone to misunderstand the implications of a discontinuous theory of change such as mutation, and to invoke orthogenesis or Lamarckism as explanatory agencies: and, since there exist more rare than abundant species, the biogeographer will have to discount the fact that he is dealing mainly with processes irrelevant to the major trends of evolution regarded as a long-range process.

Selection in a Mendelian World

In our attack upon the problem, we must first mention some implications of recent genetics. Essentially, the modern conception may be put as follows. The notion of Mendelian *characters* has been entirely dropped. Instead of a given gene having a constant effect, its actual effect is dependent upon the co-operative action of a number of other genes. Mutations which in one gene-complex are pathological, in another may be perfectly harmless, and in yet another advantageous. The adjustment of such mutations to the needs of the organism may occur entirely through recombination of existing modifiers, or, after a preliminary and partial buffering by this means, the final adjustment may have to wait upon further mutation.

Thus, evolution need not occur by a series of sharp single steps; each such step is immediately *buffered* by ancillary changes in genes and gene-combinations. What evolves is the gene-complex; and it can do so in a series of small if irregular steps so finely graded as to constitute a continuous ramp.

Nor is the pathological character of many mutations at their first appearance necessarily a bar to their final evolutionary utilization by the species. The mutant gene *eyeless* in *Drosophila* was originally described as considerably reducing the size of the eyes, in some cases to complete absence, markedly decreasing fertility, and depressing viability. When, however, a stock for eyeless was inbred for a number of generations, it was found that practically all had normal eyes and showed little reduction in either fertility or viability. On outcrossing to the normal wild type and re-extracting the recessives in *F*2, it was found that these once more manifested the original characters of eyeless, though in even more variable degree.

The explanation of these facts is that the manifestations of eyeless are readily influenced by other genes, and that in general those modifiers which make for normal viability and fertility also make for normality in eye-size. Thus, natural selection acting upon the recombinations of modifiers present in the stock speedily saw to it that the combinations making for the manifestation of reduced eyes were eliminated. In competition with the wild-type allelomorph, eyeless would be eliminated; but in stocks pure for eyeless, the genes to be eliminated will be the plus modifiers of the mutation.

Selection of this type, it now appears, is a constant and indeed normal process. It has become almost a commonplace in animals used for genetic analysis to find that mutant types which at first are extremely difficult to keep going, after a few generations become quite viable. This has repeatedly occurred in *Gammarus*, for example, as well as in *Drosophila*, and is also known in mice and nasturtiums. R. A. Fisher has extended this concept to explain dominance and recessiveness in general. These are to be regarded as modifiable

* From the presidential address to Section D (Zoology) of the British Association, delivered at Blackpool on September 10.

characters, not as unalterable inherent properties. Dominant genes, or most of them, are not born dominant: they have dominance thrust upon them. Mutations *become* dominant or recessive, through the action of other genes in the gene-complex.

In addition to the initial or intrinsic usefulness of a few small mutations, we have also the fact that mutations which are initially deleterious may become advantageous either in an altered environment or in an altered genic background, and the further fact that many mutations or Mendelizing variations cannot be described as intrinsically useful or harmful, but vary in their selective effects with variation in environmental conditions.

We must now discuss the processes of evolution and the role which selection may play in them. Darwin himself happened to confuse the issue by calling his greatest book the "Origin of Species". Evolution, however, must be dealt with under several rather distinct heads. Of these, one is the origin of species—or we had better say the origins of minor systematic diversity. Another is the origin of adaptations. A third is extinction. A fourth, and in many ways the most important, is the origin and maintenance of long-range evolutionary trends.

The Origins of Species

First, then, we have the origin of species. It is logically obvious that every existing species must have originated from some pre-existing species, but equally clear on the basis of recent research that it may do so in one of several quite different ways. A single species as a whole may become transformed gradually until it comes to merit a new specific name. Or it may separate, also gradually, into two or more divergent lines. Or it may hybridize with another species and the hybrid product then, by doubling of the chromosomes (allopolyploidy), give rise at one bound to a new species. Here, instead of one species diverging to form two, two converge to form one. So far, convergent species-formation is known only in plants. In these cases hybridization, apparently involving many more than two forms, together with recombination, chromosome-doubling and apogamy, appears to have been, and still to be, at work. A similar process, but without chromosome-doubling and apogamy, occurs in man. Thus species-formation may be continuous and unilinear; continuous and divergent; abrupt and convergent; or what, following a recent writer, we may call reticulate, dependent on constant intercrossing and recombination between a number of lines, and thus both convergent and divergent at once.

Divergent splitting must clearly be postulated on a large scale, if only to account for the rapid increase of the number of forms in newly evolved groups such as the higher placental orders. What without question are different stages of the process are yielded by a study of geographical distribution. Physiological subspecies are of a similar nature.

In all these cases isolation, whether geographical or physiological, is involved. We cannot be sure whether isolation simply makes it easier for selection to cause adaptive divergence in relation to local conditions, or whether in some cases at least, by some method as yet obscure, it permits the fruition of mere random and biologically useless variation. It does not matter in principle whether isolation is effected gradually or abruptly; in any case subsequent divergence will be gradual (except the cases of convergent species-formation, where the isolating process itself produces marked differences in appearance).

Biologists have realized for some time that the term *species* is loose and difficult of definition. However, whether we can define species or not, or whether we ought to emphasize the distinctions between different kinds of species by refinements of terminology, it remains true that species are genuine biological units. On the other hand, we can distinguish in principle between the causes of their isolation and the causes of their divergence.

From the point of view of natural selection, species will then fall into two contrasted categories. On one hand we have those in which natural selection can have had nothing to do with the origin of the basic specific characters, but merely acts upon the species as given, in competition with its relatives. These include all species in which character-divergence is abrupt and initial. On the other hand, we have those forms in which character-modification is gradual. Here natural selection may, and on both deductive and inductive grounds often must, play a part in producing the characters of the species. This helps to bring home the heterogeneity of the processes which we lump together as 'evolution'.

Adaptation and Selection

We next come to the origin of adaptations. How has adaptation been brought about? Most biologists look askance at orthogenesis *sensu stricto*, and also at Lamarckism. As Fisher has cogently pointed out, the implications both of Lamarckism and of orthogenesis run directly counter to the observed fact that the great majority of mutations are deleterious.

There remains natural selection. We must invoke natural selection whenever an adaptive structure involves a number of separate steps for its origin. A one-character, single-step adaptation might clearly be the result of mutation. But when several or many steps are involved, it becomes inconceivable that they shall have originated simultaneously. The improbability is therefore enormous that they can have arisen without the operation of some agency which can gradually accumulate and combine a number of contributory changes: and natural selection is the only such agency that we know. Natural selection achieves its results by giving probability to combinations which would otherwise be in the highest degree improbable.

This important principle clearly removes all force from the 'argument from improbability' used by many anti-Darwinians, such as Bergson. It helps us also to detect the fallacy sponsored by T. H. Morgan, who has asserted that natural selection merely preserves certain among the hosts of recombinations, and that, in the absence of natural selection, in addition to the known forms of life a vast assemblage of other types would exist which have been destroyed by selection.

According to the view of the pre-adaptationists, variations occur which would be adaptive in some new environment or way of life, and their possessors then find their way into that environment or take up that way of life. What we have previously said makes it clear that this can only apply to the early stages of an elaborate adaptation, not to its whole history. Mutations, however, do occur which may be described as *potentially pre-adaptive*.

In general, the evidence that we possess goes to show, first, that selection can be very efficacious in altering the mean of a population within the range of existing variability; secondly, that a relaxation of selection will allow the type to deviate away from adaptive perfection, quite outside the range of variability to be found where selection is more stringent; and thirdly, that adaptive characters may advantage their possessors in such a way as to exert definite selection-pressure in their favour, and that accordingly selection can have a continuous guiding effect towards adaptive perfection.

Evolutionary Trends

We must now consider long-range evolutionary trends. It is quite clear that many of these are adaptive. So obvious is this fact that it has found expression in the current phrase *adaptive radiation*.

It is hard to understand why the trends seen in adaptive radiation have been adduced as proof of internally determined orthogenesis. Whenever they lead to improvement in the mechanical or neural basis for some particular mode of life, they will confer advantage on their possessors and will come under the influence of selection; and the selection will continue to push the stock further and further along the line of development until a limit of perfection, usually determined by quite simple mechanical principles, has been reached.

The only feature inviting orthogenetic explanation is the directive character of the trends. But on reflection this too is seen to be not only explicable but also expected on a selectionist point of view. Specialization, in so far as it is a product of natural selection, automatically protects itself against the likelihood of any change save further change in the same direction.

However, that this apparent orthogenesis is determined functionally is excellently shown by the evolution of the elephants, during which the effective reach of the animals for their food was continuously increased, but the structural basis was wholly altered. It is impossible to stretch the principle of internal orthogenesis to cover a process of this type.

The same principles would seem to apply in general to small-scale adaptations as to long-range adaptive trends, except that since such adaptations frequently concern only one particular function and not the organism's main way of life, it should be easier for evolutionary direction to be changed, and for adaptation to set off on a new tack.

An important difference will be found between abundant and scarce species. In the latter, competition will be more with other species, while in the former it will be more between members of the species itself. In general, this latter or *intra-specific* type of selection is more widespread than the inter-specific.

It is a common fallacy to think of natural selection as first and foremost a direct struggle with adverse weather, with enemies, or with the elusive qualities of prey. The most important feature of the struggle for existence is intra-specific competition.

It is another fallacy to imagine that because the major elimination of individuals occurs in one period of life, therefore selection cannot act with any intensity on the phase of minimum numbers. Selection, in fact, can, and does, operate equally effectively at any stage of the life-cycle. Further, elimination is far from being the only tool with which selection operates. Differential fertility of the survivors is also important, and in man and many plants is probably the more influential.

(*To be continued.*)

The Engineer and the Nation

IN his presidential address to Section G (Engineering) of the British Association, delivered on September 10, Prof. William Cramp took as his subject "The Engineer and the Nation" and, in the course of a very human and entertaining sketch, found opportunity to define the special functions of the engineer, to claim for him an appropriate degree of authority and independence in his own domain and to discourage the prevalent repression of technical knowledge and skill in the interest of commercial advantage or in favour of false standards of economy. The activities of the engineer, he holds, are closely linked with the national life and its progress and, to a very large extent, take the form of applying and bringing to the service of the community the knowledge previously gained by the physicist, the chemist and the metallurgist. He is not, however, detached from the work of fundamental research, for his training is in close touch with it and enables him frequently to bring to a conclusion the unfinished work of his collaborators in the field of pure science. As an instance of this, Prof. Cramp ascribed to the engineer the evolution of the Cooper-Hewitt arc rectifier from its humble beginnings to its present outstanding position as the most important converter in heavy electrical engineering.

The fundamental differences between those engaged in the pursuit of pure science and the engineer are to be found in the conditions under which they must work and in the ends toward which they strive. For the investigation and study of natural phenomena and their laws, the scientific worker requires quiet detachment and, for him, the main purposes are to know what is unknown, to observe behaviour, to determine natural laws, to construct a framework of principles fitting the collected observations. The engineer, on the other hand, must keep in close touch with the life and interests of the community, and the major part of his work is done under the conditions of intense and orderly bustle associated with construction. His aim is to apply knowledge, to link it with the experience of the ages, to utilize and to conserve the energy that is available for the increase of the amenities of life. In this way, engineering has become the greatest instrument of civilization the world has known ; at least three-fourths of its work consists in making, maintaining and developing communications.

While it may not be possible to accede to Prof. Cramp's claim that, left undisturbed by politicians, scaremongers and patriots, the engineer would render war impossible, the thoughtful will be able to appreciate from the context of examples and suggestions the underlying truth and moral of his case. But whether in peace or in war, the products of the knowledge and skill of the engineer as a pioneer are vitally important, so to the nations and to the world at large his activities and the ends to which he directs them are matters of supreme concern. Thus it is that the man, the engineer, is at all times closely associated with human relationships, and his opportunities for development or loss of character are great ; his chances of salvation and his risks of damnation are increased, for character does not mature in cloisters, and exposure is necessary for the proof of it.

Finding the engineer so privileged in the nature of the services he can render to the community, Prof. Cramp then asks to what extent do his fellow men recognize his real and potential importance, and how far does he abuse his position or allow himself to be made the tool of less scrupulous men. Although the period and extent of his training correspond to those of the doctor and lawyer, the engineer has no similar status nationally recognized, nor does he on the average receive the same rewards. Men responsible for the design of high-speed turbo-generators or for other work transcending that of the doctor in respect of the safety, not merely of individuals but of masses, may never receive more than £750 per annum. On the other side of the account, instances are given of unprofessional conduct ; while it is out of place here to recapitulate details of the commercial practices of individuals, firms, and associations to which Prof. Cramp referred, it is to be hoped that his plea for a higher standard of integrity may have good effect and may assist in promoting the reforms he suggested.

In the forefront of these reforms Prof. Cramp places the need for a body with statutory powers to define the qualifications and status of those who may use the titles at present freely adopted, to prevent unqualified persons from jeopardizing life and also to check unprofessional conduct. Expressly it is stated that such a measure of immunity as has been achieved by the legal and medical professions is not desired. An urgent reform also is the proper representation of science on governing bodies in industry and in technical departments in the State and municipalities ; and here it was suggested that the British Associations should take steps and also appoint a committee. Some means by which the engineer shall not be over-ruled in technical matters by the commercial man, drastic

alteration of the patents procedure in the law courts and a suggestion for the revision of the constitution of the councils of the trade associations by making them representative of makers, contractors and buyers are also urged as much needed reforms.

Finally, there is the question of the general professional code. Backsliding, Prof. Cramp finds, can only be corrected by a higher training of character and, in his concluding words, "The remedy lies in the hands of parents and those who control educational institutions: it is urgent and of national importance. I commend its consideration to the Board of Education, the Committee of Vice-Chancellors, and to the members of Section L. British engineers have, in the past, earned a great reputation for reliability and straight dealing. This is a national asset of real value, which can only be maintained if, as in our national games, we learn to place integrity before self-interest".

The Place of Science in General History

A MARKED change has taken place in recent years in the attitude of the 'general historian' to natural science. Fifty, or even forty years ago, it was possible for S. R. Gardiner to write a history of England covering the life of Newton, and to allude to Newton only as Master of the Mint. To-day, in every book of similar scope and size, something would be said about the achievements of science in the seventeenth century, as well, probably, as something about the connexion of science with the industrial developments of the eighteenth and nineteenth. This is all to the good, and in the same direction should be noted the recent great interest in 'pre-history'. The last will probably prove in the end the decisive factor in changing the focus from which we regard the past, or rather—to use a more appropriate metaphor—the centre of gravity on which the past and present repose. As this is the capital point in the discussion, it will be best to make it clear at starting.

The older, and still prevalent, view regarded the agents and the machinery by which the government of nations is carried on as the dominant factor in human affairs. Hence, in practically all historical works of a general kind, the writer spent his chief, often his whole, pains in describing this type of action and the characters of those who did it. For this reason all of us have some sort of picture in the mind of the most eminent and interesting kings, emperors, soldiers and statesmen. They serve, of course, a very useful function as landmarks in the course of time, as *points-de-repère* round which we may collect the other fragments of knowledge which we possess. But the newer and truer point of view carries the matter a good deal further back. The really determinant factors in human life in the long run are more profound, more obscure and, above all, more purely mental. The revelations of pre-history make this clear. We find, probe as far as we may, that, millenniums ago, the mind of early man was at work making inventions and observations which laid the foundation of all the civilization which has followed. When we grasp this, we must be led on to see that the mental process is a continuous one and that the abstract-thinking mind becomes more, and not less, dominant as history proceeds.

The question, therefore, which every honest person must put to himself is this: Do we really desire to know the true connexions of things in the past, the authentic structure of the society of which we are a part, or do we prefer the superficially more exciting incidents which the novelist historians are always ready to turn out? Is it the 'private life of Henry VIII' and the mistresses of Charles II, or the scientific revolution which took place between those monarchs, which really interests us the most? All are a part of history, and all historians and readers of history must select.

One must not be understood to belittle the importance of the governmental side of history, or to be attempting to identify it with the personal foibles of its prominent actors. But it is necessary in the interest of truth to assert that hitherto there has been a vast miscarriage of interest and attention in this matter, which is a vital one for the intellectual integrity of the race.

How may the correction be best carried out, without revolution, and without lessening the total amount of interest which the thinking public is inclined to give to history?

In the first place, the change must take place gradually and by the mental conversion, both of those who write and those who read history. This follows from the very thesis that we are maintaining. Mind rules the world, and this is a case of men's minds awakening to the real nature of the process. Evidence is abundant that most of the competent minds which have turned to the subject now realize, more or less dimly, the nature of the truth, and the truth is spreading. Lord

Acton at Cambridge was the turning point in England. Few would now contend, with Seeley, that "history *is* political history". Or if a stray campaigner, like Sir John Marriott, is found to say so, he can only be understood to mean that 'the history *I* write, or am interested in, is political history'. Most students of history would now admit our general thesis on Acton's lines and add that they personally, not being competent in mathematics or physical science, prefer to leave such parts of the historical field to those who are. Thus, though the battle has been won in the main strongholds, it remains to carry out the organization and administration of the conquered area in the new spirit, and this will take time and various expedients. A few may be suggested.

In large encyclopædic works, like the "Cambridge Modern History", separate chapters may be, and are, included on science, as on art, etc., by specialist writers, in the midst of the main current or political and social history. This is much better than nothing, but does not meet the need of synthesis in treatment, or of showing how the scientific spirit has made itself felt in the realms of government, religion or social life. The work is much better done when the historian, though he may not have had a scientific training in his youth, applies his own mind to the subject and does his best as one man. G. N. Clark's "History of the Seventeenth Century" is a very spirited and successful essay of that kind. On a much larger scale, Preserved Smith's "History of Modern Culture" goes even too far in the other direction, for, by not preserving any political outline, it rather loses the sequence and position of events. Some such outline is necessary to keep our minds in order, though there is no need that it should be the old dates of kings and queens, and increasingly, in the future, history will need fresh landmarks.

That the student and writer of history should be, if not personally trained in science, at least in constant mental contact with those who are, is of course the only right way. But it should not be forgotten that the student of science may be himself as much of a narrow specialist as any student in the Record Office. Both need the philosophic view, that is, the constant and sincere attempt to see things whole and in their relation to the whole.

Now seeing things whole in history leads to sociology, if indeed it is not the best definition of what sociology aims at. Therefore it is relevant to our subject to point out that there is at present only one chair of sociology in Great Britain, that founded at the London School of Economics by the late Mr. Martin White. It would undoubtedly tend to a more synthetic view of history (which includes putting science in its due place) if wealthy and enlightened donors could be found to institute other chairs, and above all at the two older universities. Meanwhile the keen prosecution of anthropology, fostered especially at Oxford by Dr. R. R. Marett, is doing something to fill the gap. It is not suggested that sociology should control the teaching of history but, being essentially philosophic and connected with all the branches of the study of man, it acts as a link and promotes the synthetic view among all who come in contact with it.

For this must be the final and guiding thought in the minds of those who wish to see science occupy its true place in our view of the past. We welcome its recognition, even in the disconnected form in which it generally appears. But this is merely the first step, and by itself not of much significance. Integration is needed : not the extra chapter inserted in the general survey, narrating the discovery of the spinning jenny or even how Watt was helped by Black in developing the steam-engine, but a consideration of the social origin and social effect of these things. They go back to the roots of man's thinking ; they go forward indefinitely, modifying the way in which he lives and regards the world.

The line of demarcation does not seem too difficult between what may be expected in general history about science and technology and what is properly left to specialist works. It would be improper and absurd to include the detailed theorems of Euclid or the drawings for Watt's steam-engine in a work on general history. But one should be able to gain some idea of how Greek geometry arose and what it meant for the unification of ancient thought, and, in the latter instance, it is essential that one should be led to think how modern inventions have been conditioned by science and what changes and problems have been laid upon us by a mechanized world.

The students and writers of history are still only at the threshold of this inquiry, but it is a welcome advance to have come in sight of it. There is now a lively demand for some teaching as to the history of science, which is taking shape in Cambridge this term in a new series of regular lectures. Prof. Lancelot Hogben expressed the same desire in his recent lecture on the "Retreat from Reason". But most vital of all would be the enlistment of the body of general historians in the cause. They have the historical spirit and the technique. We owe mainly to them the general interest and respect for the past which distinguishes our country. An alliance between the two forces, and an enlargement of the old historical discipline, would be an educational revolution of the most far-reaching type. F. S. M.

Obituary

The Right Hon. Lord Moynihan, K.C.M.G., C.B.

LORD MOYNIHAN died on September 7 at his home, Carr Manor, Leeds, in his seventy-first year. His fame was world-wide, and great gifts with which he was endowed made him the greatest surgeon of the day both in Great Britain and abroad. His father was Captain Moynihan of the 8th Foot, who gained the Victoria Cross in the Crimean War. Ten years later, on October 2, 1865, Berkeley Moynihan, his only son, was born at Malta. He was educated at the Royal Naval School and entered the Leeds Medical School for his professional training. He took his M.B. at the University of London in 1887 and the fellowship of the Royal College of Surgeons of England in 1890. After graduation he started teaching anatomy in the Leeds Medical School; later he was appointed assistant surgeon to the Leeds General Infirmary and then in due course surgeon and consulting surgeon and professor of surgery in the University of Leeds.

Moynihan's success as a teacher and reputation as a surgeon brought him early a lucrative practice in the north of England, and he was rewarded with a knighthood in 1912. During the Great War he was appointed consulting surgeon to the Northern Command, and later, consulting surgeon to the British Expeditionary Force, with the rank of Major-General A.M.S. He was made K.C.M.G. in 1918 and a baronet in 1922. In 1929 he was created Baron Moynihan of Leeds, the only surgeon with the exception of Lister to receive a peerage. At the Royal College of Surgeons he passed successively through all the offices and held the post of president for six years (1926–32), a longer time than any of his predecessors.

Many qualities contributed to make Moynihan the man he was. Physically he was strong, rarely ailing and possessed of abundant energy and vitality. Cheerful in disposition and willing to please, he was eager to be liked. Perhaps this was the Irish element coming out in him. It is to his credit that though he loved to please, he was just as pleasant to an omnibus conductor as he was to a titled patient. Mentally he was alert, quick-witted and ready to seize a new idea, make it his own and improve on it. As a speaker he was pre-eminent. His addresses and speeches, of which he made many, though carefully prepared, were delivered in faultless manner without a note, and their charm and persuasiveness were enhanced by a full melodious voice.

These attributes, great as they were, would not have led to Moynihan's high position if it had not been for his great powers as a surgeon. In the early years of this century his fame was growing, and a visit to Leeds to see Moynihan at work became a routine for surgeons visiting England from abroad and especially for surgeons from the United States, amongst whom he had many friends and with whom his reputation stood high.

The reason for this high reputation may be ascribed in the first instance to technical skill. Moynihan was a master in technique and it was a joy to watch him at work. There was nothing of the slapdash, cut-and-thrust method of the pre-Listerine surgeon. Instead infinite patience and infinite gentleness, by which means difficult and dangerous operations were brought in his hands to a happy issue where more rapid but rougher surgeons failed. Moynihan saw also the great value of careful preparation before operation so as to bring the patients into the most favourable condition, and to this end he devoted as much attention as to the operation itself. To use his own words, he raised his surgery to the sanctity of a sacrament.

But Moynihan was more than a deft user of his hands. He was intensely interested in the scientific side of his profession and made considerable contributions to clinical science which of themselves entitle him to fame and to rank with the Masters of Medicine. The most important of these are in connexion with diseases of the duodenum, stomach and gall bladder. The recognition of duodenal ulcer and its successful treatment we owe to Moynihan. By skilfully correlating the symptoms as related by patients and observations made in the operating theatre, he drew a clinical picture of the disease by which it can now be recognized with ease and accuracy.

The operation of gastrectomy for gastric ulcer received a great impetus in the hands of Moynihan. He picked up the idea, probably, from Polya, but he modified and improved it and, what is more, taught other surgeons to do it too. Other important contributions were made on diseases of the spleen, pancreas and gall bladder, and again he showed that the morbid condition was characterized by a definite clinical picture.

By these means Moynihan was led to inculcate a doctrine, the truth of which is being but slowly admitted, that there is a pathology of the living, distinct from the autopsy chamber. He held that the beginnings of disease processes should be studied while patients are yet alive, and that the best place to study these is the operating theatre, which he termed his laboratory.

Associated with this technical excellency was a power of organizing ability. Many years ago Moynihan realized that in order to raise the standard of surgery throughout Great Britain—and this ideal was very near his heart—it was essential not only to have a high individual standard, but also to create a free intercommunication and a comradeship between surgeons. He described these ideas in a letter written only last May. He writes:

"In my early days I was struck by the lack of cohesion among members of my profession. Surgeons in one town knew little or nothing of surgeons elsewhere. A surgeon from Manchester had never, so far as I could hear, visited an operation theatre in Leeds, nor had one ever been called in consultation.

As a consequence it was not infrequent to listen to disparagement of one surgeon by another and jealousies openly expressed were too often heard. I thought this all wrong. If we were indeed members of a 'noble profession' as we most certainly were, then it was clearly an obligation upon us to speak well of one another. It seemed to me that if by any means we could be brought together, it would be a great advantage to us all and that we should then be made to realize that we were not competitors, one working against another, but comrades, each working with the others against the common enemy, disease."

The means that Moynihan took to accomplish his ideal were three. First came the foundation of the Provincial Chirurgical Club (since 1929 called the Moynihan Chirurgical Club). This body of surgeons met among themselves, visited each other's clinics as well as foreign cities. In this way the most important surgeons all over the world were visited, and Moynihan may be regarded as the finest medical ambassador England ever had. The second method was the establishment of the *British Journal of Surgery*, which under his chairmanship reached the proud position of the premier surgical journal. The third means and the most important, and one in which Moynihan took a prominent part, was the foundation of the Association of the Surgeons of Great Britain and Ireland. This has proved a great success and drawn together surgeons from all over the country, raised the standard of British surgery and removed the reproach of "lack of cohesion" among members of the profession.

One of the most important works of Moynihan's life and one of which he did not live to see the full fruits was the introduction of the study of experimental surgery. Moynihan saw that if surgery is to continue active and progressive, an intensive and direct study must be made of the many problems which confront the surgeon. During his time as president of the Royal College of Surgeons, he devoted time and energy to securing surgical research scholarships and laboratory accommodation where young men entering on the surgical profession might be trained in methods of research. His efforts were rewarded, and a flourishing school of this new science is growing up, the importance of which it is hard to predict.

Moynihan's life may be described as a success, a victorious success, and the world is the richer for his being. G. E. G.

Mr. E. R. Deacon, O.B.E.

WE regret to record the death of Mr. Edgar Reginald Deacon on August 29. It may be recalled that during the early months of the Great War there was a serious shortage of high explosives; in particular, the supply of T.N.T. (trinitrotoluene) available was totally inadequate to meet the enormous requirements. It was early in 1915 that Deacon, whose province at the Research Department, Woolwich, had been the study of high-explosive munitions, made the suggestion that by mixing the available T.N.T. with ammonium nitrate it could be made to go much farther without loss of efficiency, a fact which he demonstrated experimentally. At the outset he suggested the mixture of equal weights of these materials, this mixture having the advantage that it could be filled into shell by casting in a manner similar to that hitherto used for lyddite. Within two months he had worked out the more difficult problem of preparing and filling a mixture of 80 parts of ammonium nitrate and 20 of T.N.T., which contained too much ammonium nitrate to be cast. This advance made it possible to fill five times the number of shell hitherto possible with a given weight of T.N.T.

The importance of these suggestions was immediately recognized by his chief, Dr. (now Sir) Robert Robertson, who took steps to develop these mixtures further and brought them to the notice of the Ordnance Committee and Lord Moulton. In this way, birth was given to that important series of explosives later known as the amatols. Rapid expansion of the use of amatol followed in the national filling factories under the Ministry of Munitions, and many individuals contributed with great skill and ingenuity in furthering its successful application. It was used not only for shell but also for other munitions such as bombs, mines and torpedoes, and it has been estimated that no less than 600,000 tons were used by the British Services during the War.

The importance of the introduction of amatol is indicated by a speech made by Lord Moulton in 1917 in which he referred to two inventions brought forward by the Research Department, 40/60 and 80/20 amatol. By means of these he was enabled to meet his obligations, especially with 80/20, which effected such a great saving in the use of T.N.T. He recalled the advocacy of the Research Department of this explosive, which he considered to be "the greatest single thing in importance in the supply of that wealth of munitions that has enabled our armies to expend shell to an unlimited extent".

Edgar Reginald Deacon was born in 1881 at Frome, educated at Sexey's School, Bruton, Somerset, and later studied at the Finsbury Technical College. For some time he held appointments as assistant to the late Mr. Chaston Chapman and as assistant chemist at the Clinical Research Association. In 1902 he joined the staff of the recently formed Experimental Establishment (now Research Department) at the Royal Arsenal, Woolwich, in which he remained until his death.

Deacon devoted many years to the study of high-explosive munitions and for more than twenty years was head of the high-explosives branch of the Directorate of Explosives Research. He was elected fellow of the Institute of Chemistry in 1917 and awarded the O.B.E. in 1918.

Deacon was highly original and full of resource, and many important improvements in the efficiency and safety of munitions are due to his work. The Fighting Services have lost a most valuable servant. To quote from a letter received from another Government Department: "All who had official dealings with Mr. Deacon will gratefully remember his wide knowledge, wise counsel and willing helpfulness."

News and Views

Awards for Cancer Research

THE International Union against Cancer, of which the headquarters is in Paris, has awarded a prize for scientific work on cancer to Profs. E. L. Kennaway and J. W. Cook of the Research Institute of the Royal Cancer Hospital (Free), Fulham Road, London. The prize, which is the gift of the Union Minière du Haut Katanga, the well-known Belgian firm engaged in the production of various metals including radium, consists of 50,000 francs together with 50 milligrams of radium for use in research work. The presentation was made last week in Brussels during the Second International Congress on Cancer by Dr. Jacques Bandaline, the director of the Bureau of the International Union against Cancer, in the presence of the Prime Minister of Belgium and numerous delegates to the Congress. Mr. Cecil Rowntree, senior surgeon to the Royal Cancer Hospital, and a representative of Great Britain on the International Union, read a telegram of congratulation from the Earl of Granard, the president of the Hospital. Prof. Cook, in expressing thanks for the award, paid a tribute to the essential part played in the development of the research by four colleagues, Drs. Mayneord, Hieger, Hewett and Haslewood. Prof. Kennaway was educated at University College, London, New College, Oxford, and the Middlesex Hospital. He is professor of experimental pathology in the University of London and director of the Research Institute of the Royal Cancer Hospital (Free), London, and is author of several papers on biological chemistry and cancer. Prof. Cook, who was educated at University College, London, is research chemist at the Royal Cancer Hospital, and is professor of chemistry in the University of London. He is also an honorary secretary of the Chemical Society. He has written numerous papers on organic chemistry, particularly in relation to cancer.

Bust of Kelvin for the Smithsonian Institution

THE presentation of the bronze bust of Lord Kelvin, by the late Herbert Hampton, to the Smithsonian Institution, is to take place on October 8 at Washington, D.C. The English-speaking Union has arranged a luncheon at the Hotel Willard, Washington, in honour of the occasion, at which Dr. C. G. Abbot, Secretary of the Smithsonian, will receive the bust. Mr. V. A. L. Mallet, counsellor of the British Embassy at Washington, will transfer the bust on behalf of the English-Speaking Union of the British Empire to the English-Speaking Union of the United States. Dr. W. F. G. Swann, of the Bartol Research Foundation, acting as the American Union's spokesman, will then officially make the presentation to the Smithsonian Museum, and Dr. Abbot will reply. The bust was dispatched from England on September 23. It is to receive a prominent position at the Smithsonian Institution, and it is hoped that it will form the nucleus of a permanent exhibit to be collected indicative of Lord Kelvin's contributions to various branches of science on both sides of the Atlantic. The late Herbert Hampton, the famous sculptor and friend of Lord Kelvin, made this bust from life in 1902, five years before Lord Kelvin's death. It has never been cast before, although it was used as a model for the bas-relief on the Queen Victoria Memorial at Ipswich. The plaster cast was carefully preserved by the sculptor's widow, from which a bronze has now been cast for the Smithsonian. Hampton was well known for his public memorials and portrait busts of celebrated people. His works include five memorials to Queen Victoria, statues of King Edward VII and King George V, the well-known figure of the Duke of Devonshire in Whitehall, the Marquess of Salisbury (at the Foreign Office) and Lord Hardinge (at Bombay).

Wilhelm von Waldeyer (1836-1921)

OCTOBER 6 marks the centenary of the birth of the eminent anatomist, embryologist and anthropologist, Wilhelm von Waldeyer, who was born in the village of Hehlen in Brunswick, and died on January 23, 1921. He first devoted his attention to natural science and mathematics, but under the influence of Henle took up medicine, which he studied at Göttingen, Greifswald and Berlin, where he qualified in 1861. After acting as von Wittich's assistant at the Königsberg Physiological Institute, he went to Breslau in 1864 where he was first assistant to Heidenhain; then he became extraordinary professor of morbid anatomy in 1865 and full professor in 1867. In 1872, he was appointed professor of normal anatomy at Strasbourg and was transferred in 1883 to the corresponding chair at Berlin, which he occupied until 1917. His literary output was considerable, as is shown by the bibliography of 269 references in Sobotta's memoir (*Anatom. Anzeiger*, 1923). His principal works were on the ovary and ovum (1872), sclerotic, cornea and conjunctiva (1874), an atlas of human and animal hairs (1884), a history of anatomical instruction in Berlin (1899) and Darwin's doctrine (1910). He also made important contributions to our knowledge of cancer, retroperitoneal hernia and pelvic viscera, and was the first to describe the neuron theory, the ring of lymphoid tissue in the pharynx and chromosomes. He was co-editor with La Vallette St. George of *Archiv für mikroskopische Anatomie*, Virchow-Hirsch *Jahresbericht* and *Archiv für Anatomie und Physiologie*.

"Natives" in Western Australia

UNDER the provisions of an Aborigines Bill introduced in the Legislative Council of Western Australia on September 23, it is now proposed that all people

of colour in Western Australia, whether full-blooded or of mixed origin, shall no longer be known as "aborigines", "half-castes", or "near whites", but shall be termed "natives". While this proposal no doubt removes what has been felt in certain circumstances to be a stigma, it perpetuates and gives official approval to a troublesome ambiguity. The Bill was introduced on behalf of the Western Australian Government by the Chief Secretary, Mr. W. H. Kitson (*The Times*, Sept. 24). As it stands, the proposals deal with certain matters affecting the natives to which attention was directed recently in the drastic report of a commission of inquiry criticizing native conditions and the organization and functioning of the Western Australian Government's provision for the protection of the aborigines (see NATURE, **135**, 798). A better system of control of the natives is to be introduced; and a serious attempt is to be made to grapple with the grave problem of the conditions affecting native mothers and their children; while the employment of young females will be regulated to prevent exploitation by their employers. Other matters which come under view or revision are the terms of native tenure of property and land, the prohibition of the sale of intoxicants to natives, and the delicate question of the curtailment of tribal custom and practices which "are calculated to cause bodily injury or to militate against the Department's work of amelioration". Finally, and in view of past history, perhaps most important of all, native courts are to be established for the trial of offences committed by one native against another. From the brief summary which so far has been transmitted by cable, it would appear that the Government is making a determined effort to remedy the graver defects of its system to which attention has been directed, and that in certain respects the practice of the State will be brought into line with that of the Federal Government in its relations with the aborigines of the Northern Territory.

Foundation Rites at Maiden Castle, Dorchester

Two important discoveries mark the approach of the closing week of excavation at Maiden Castle, Dorchester, where Dr. R. E. Mortimer Wheeler is at work on behalf of the Society of Antiquaries and the Dorset Natural History and Archæological Society. The adult burial (see NATURE, Sept. 5, p. 395) is now found to date from the Iron Age *c.* 300 B.C. and to be situated at the base of the rampart of the earlier enclosure at the point of contact with the rampart of the larger and later Maiden Castle. The character of the filling of the grave indicates that it is contemporary with the construction of the latter, and its position, as well as the fact that it is the only adult burial so far discovered within the enclosure, fully justify the view taken by Dr. Wheeler that it may possibly have been a ceremonial burial connected with foundation rites, such as are known to have been observed elsewhere, to mark the first great extension of Maiden Castle. The second discovery is that of a third structure on the summit of the hill adjoining the Roman temple and contemporary with it. It is built of dry stone walling, without mortar, and is circular or polyhedral in form. Its character is still under investigation. Further details connected with the east gate have now been made clear. The southern of the two openings, which was previously thought to be an addition, has now been shown, it is reported in *The Times* of September 26, to be an original feature of the earliest structure, as a causeway of unexcavated chalk runs across the line of the ditch in front of it. This causeway was much mutilated in late Roman times, when the entrance was blocked by a masonry wall built with a core of chalk quarried from the causeway. The line of quarrying, associated with Roman material, has been discovered, and the excavation here is now nearly completed.

Archæological Investigations in the Northern Transvaal

REMARKABLE results obtained since 1933 in the excavation of two sites in the Zoutpansberg District, Northern Transvaal, have evoked so many inquiries that Prof. C. van Riet Lowe, director of the Bureau of Archæology, University of South Africa, has been authorized by the Archæological Committee of the University of Pretoria, the body conducting the investigation, to prepare a preliminary report, which appears in *Antiquity* of September. The two sites, Mapungubwe, and the adjacent and earlier site, Bambandianalo, are situated on a farm near the junction of the Shashi and Limpopo rivers, about one hundred and sixty miles south-west of Zimbabwe, and just over fifty miles due west of Messina, where there are extensive remains of pre-European copper workings. The farm is now the property of the Union Government, having been purchased on the urgent representations of Prof. Leo Fouché. This public-spirited action has proved of inestimable benefit to the advancement of archæological studies in South Africa by making possible the scientific excavation of sites hitherto undisturbed. Notwithstanding the spectacular situation of the Mapungubwe fortress with its dry-stone walling on an inaccessible sandstone cliff, one hundred feet high, and the wealth of gold and other cultural objects found here, in the associated cemetery, and on the earlier site of Bambandianalo (see NATURE, **137**, 1024), these sites do not differ essentially from other sites in the region and in Rhodesia, including the Zimbabwe explored by Dr. D. Randall-MacIver and Miss Caton-Thompson; but these latter have suffered from the disturbance of treasure hunters and unauthorized excavation. Hence it has now been possible to establish with certainty a cultural sequence, from which it is inferred that the earlier of the two cultures found here, that of a copper-working pastoral people, may represent the earliest wave of the incursion into what is now South Africa of the Bantu-speaking peoples.

New Aeroplane Height Record

ON September 28, Squadron Leader F. R. D. Swain, a test pilot at the Royal Aircraft Establishment, Farnborough, set up a new height record for

aeroplanes when he ascended to 49,967 ft. According to *The Times* of September 30, Squadron Leader Swain was flying a low wing monoplane of wing span 66 ft. and length 44 ft. with a super-charged Pegasus engine designed to give 370 h.p. at the start, 457 h.p. at 40,000 ft. and 380 h.p. at 50,000 ft. The pilot was enclosed in an air-tight two-piece suit of fabric covered on both sides with rubber and surmounted by a helmet with a transparent window. His air supply was fed into the right side of the helmet and passed out on the left to a canister in which water vapour and carbon dioxide were removed before the air returned to the circulation. The cockpit of the aeroplane was also enclosed, and warmed from the engine exhaust. It appears that Squadron Leader Swain found no particular difficulty in the ascent, but when coming down, the window of his helmet and the cover of the cockpit were badly obscured by frost. He also experienced unpleasant sensations of suffocation accompanied by weakness, and was obliged to use his emergency knife to rip open his helmet. He landed safely after a flight lasting nearly three and a half hours. The height reached was nearly thirteen hundred feet above that attained last month by M. Georges Détré at Villacoublay, France.

Crop-growing without Soil

ATTENTION has recently been given to production of green fodder for cattle and other farm stock without the intermediary of the soil. In Great Britain the method advocated is apparently of German origin, and it is claimed that the fodder is grown from seed in ten days. According to published accounts, a layer of seed (maize or other grain) is spread on a perforated metal tray, and the tray is placed in a cabinet, constructed to hold a series of trays. The seed is damped daily by water, containing a small percentage of nutrient salts, from a tank placed on the top of the cabinet, and, when an adequate temperature is maintained, the seed germinates and in 10 days a growth of shoots some 12 inches high is obtained. This growth of shoots, with the mass of rootlets, is then given to the stock. Several trials have shown that this fodder is readily eaten by stock, but carefully controlled experiments are necessary to demonstrate the full nutritive value and the costs of production of this fodder. At the University of California experiments have been carried out by Prof. W. F. Gericke on the growing of vegetables and flowers in tanks of water to which the necessary chemical fertilizers have been added. The seeds are sown in a layer of sawdust or moss supported by wire netting above the water; the roots grow downwards and remarkably rapid growth and a high yield has been demonstrated. Although still in the experimental stage, this process has attracted the attention of commercial vegetable and flower growers in California.

Huskless Oats

DURING the past two years considerable public interest has been aroused in a variety of huskless oats introduced by Mr. William Parker of Babingley Hall, near King's Lynn. In 1936, with the agreement of the introducer, the National Institute of Agricultural Botany carried out accurate yield trials of this variety in Cambridgeshire, Somerset, Shropshire, Hampshire, Norfolk and Yorkshire. The rate of seeding (45 lb. per acre) and the sowing times (end of March and beginning of April) were those recommended by the introducer. The variety with which the oat was compared was Victory, and at each centre both were sown on the same day. Victory, however, was sown at the normal seed rate for that variety—3–4 bushels per acre. On the basis of grain as threshed, Victory outyielded Parker's Huskless oat by 97 per cent, but to obtain a true comparison 28 per cent must be deducted from the grain weights of Victory, this being the normal husk percentage of that variety. On this basis, at only one centre—Cambridge—did Parker's Huskless oat outyield Victory, and then by the insignificant amount of 2 per cent. Averaging the results from all six centres, taking both on the above basis of naked grain, the grain yield of Victory was 41·2 per cent heavier than Parker's Huskless oat. No shattering at harvest took place in either variety.

Research and the Jute Industry

A PARAGRAPH under this heading appeared in NATURE of August 22 (p. 322), based on an article in *Science and Culture* discussing Dr. S. G. Barker's recommendations for research in the industry. Dr. Barker has written to point out that his report was on "Jute Research" as affecting jute *manufacture*, and should not be confused with the report of the Bengal Jute Enquiry Committee, which was concerned with *agricultural* aspects. His report was submitted to the Indian Jute Mills Association, which is at present considering it. Whether it will be submitted to the Government of India is a domestic matter for the jute manufacturers to decide. On the other hand, the suggestions of the Bengal Jute Enquiry Committee regarding jute agriculture have been accepted by the Government of India and a committee formed to implement them. So far as manufacturing research is concerned, this is still under sympathetic consideration by the Indian Jute Mills Association.

Social Life in a Rural Community

A STUDY of the activities, interests and problems of young married men and women, 15–29 years of age, in the rural sections of Tompkins County, has been published by the Cornell University Agriculture Experiment Station, as part of a study of youth problems. The data were acquired by direct personal interview with each of the 347 persons included in the study. One third of the persons interviewed were men and two thirds were women. Of the whole group, 30 per cent lived on farms, 40 per cent in villages and 30 per cent lived in the open country but not on farms. On an average, these young people had spent more than two years at a high school, and two in five of the men and one in four of the women had received some college training. Only 4 per cent

of the men were unemployed, 11 per cent being employed part time; 86 per cent of the women were employed in housework and 5 per cent had part-time work.

THE commonest leisure activities of this group were reading, card playing, chess and other games and listening to radio. Outdoor activities ranked next, and were preferred by the men, followed by household activities and then hobbies and outdoor sports. 56 per cent of the men and 48 per cent of the women had two hours or less per day of leisure, but about one half had three hours or more. Only 5 per cent of them did no reading each day, but books were read much less regularly than magazines and newspapers. 65 per cent of the men engaged in farming were members of some organization, but three quarters of the others were members of no formal organization. Emphasis was placed upon the provision for social and recreational needs. 28 per cent of the men and 45 per cent of the women wished to travel, but the only other desire expressed by a significant number was to buy or build a home or to own a good farm. The men would welcome opportunity for further training in agriculture and farming, engineering and mechanics. The women emphasized the desirability of training in business subjects, nursing and home economics. Uppermost in the problems of these young persons is the lack of sociability through group relations, and the major need is that of integrating them into a satisfying social life through the development of a consciousness of common social needs and practical local organization to satisfy them.

River Survey

IN a small pamphlet of a dozen pages ("A Note of the Work of River Flow Records." River Flow Records. 6*d*.), Capt. W. N. McClean sets out a statement of the work performed by River Flow Records, the private organization of which he is the founder and director, during the period of its existence. The aim of River Flow Records, it is stated, is to obtain, in the area of a river system, records of water-levels of so comprehensive and accurate a character as to enable full information to be deduced therefrom respecting the flow and storage of water. Surveys on these lines have been carried out on the Rivers Garry, Moriston, Foyers, Oich and Ness in the Ness Basin; on the River Arkaig and Muccomer Cut in the Lochy Basin; on the River Spey and on the Aberdeenshire Dee, with results which have been detailed in a series of papers and publications. The pamphlet goes on to discuss several aspects of survey work, including water level stations, flow gauging, rainfall, temperature and wind, the compilation and presentation of records and the analysis and use of records. The author points out the influence of the work and experience gained by River Flow Records in the promotion and institution of an Inland Water Survey for Great Britain, which has been the outcome of a discussion in 1932 at the York meeting of the British Association. There are two appendixes dealing with mechanical details of river survey work.

Herpetologia

THE Chicago Academy of Sciences has sponsored the appearance of a new magazine with the above title, to be devoted to the study of reptiles and amphibians. Parts will appear quarterly, and it is hoped that the issue of such a specialized journal will help to bring together notes and short papers upon reptiles and amphibians which otherwise would be scattered and often unavailable in a multitude of other publications. The defect of such schemes is that they tend to make their particular study more remote from the naturalist who is interested in various groups of animals and endeavours to correlate the biological discoveries in them. From such a general point of view, the most interesting of the papers in the first part of the new magazine is that by L. M. Klauber describing and illustrating two varieties of a king snake, one with ringed markings, the other with longitudinal stripes. These have hitherto been regarded as distinct species, *Lampropeltis californiæ* and *L. getulus boylii*, but the hatching of broods which contained both forms shows that they are colour varieties of one form, which must be known as *L. getulus californiæ*.

Seismology in the United States

A REPORT of the Advisory Committee on Seismology appears in the Yearbook for 1935 (pp. 361–370) of the Carnegie Institution of Washington. One of the most interesting sections deals with the operations of the Coast and Geodetic Survey during the year ending June 30, 1935. Levelling of the first and second order was carried out over routes with a total length of more than one hundred thousand miles, and triangulation of the first and second order over a length of about 17,500 miles. In California, three arcs of triangulation, altogether 300 miles in length, have been carried out, and eight lines of closely-spaced bench-marks at right angles to well-known and active faults in the State. Five of these lines cross the San Andreas fault, the movements along which are responsible for many great Californian earthquakes. Each line extends about five miles on both sides of the faults, the bench marks within the first mile being only 100 ft. apart. A short time ago, a network of levels was established in order to study the subsidence of the land round San Jose (Cal.). The levelling was repeated in the autumn of 1934 and the spring of 1935. Though the work is not yet finished, it is advanced far enough to show that the subsidence noticed in the previous interval of levelling is still continuing.

Mining in South Australia

WE have received from the Department of Mines in South Australia the mining review for the half-year ended December 31, 1935 (No. 63). It is quite in the usual form; the main matter of interest is contained in the preface, signed by the Director of Mines on April 1, 1936, in which he states that during the year 1935, the mineral production from South Australian mines and quarries exceeded in value that recorded for any previous year; the total value

is 45·4 per cent higher than that recorded for 1934, which was previously the largest total. "The increase in tonnage and in value is due largely to the extraordinary rise in the production of iron ore, which has been the predominant contributor to the total during recent years." This is scarcely surprising since the value of the iron ore raised in 1934 is 84 per cent of the total value of mineral production, the output showing an increase of 50 per cent; most other minerals showed increases, the output of gold being 6·7 per cent greater than that of 1934. These statements are fairly well borne out by the reports of the Chief Inspector of Mines and the reports of the Inspector of Mines and Quarries attached as usual to this volume.

Scientific Study of Suicide

A COMMITTEE for the study of suicide consisting of ten members including Dr. Henry E. Sigerist, professor of the history of medicine at Johns Hopkins University, and Dr. Edward Sapir, professor of anthropology at Yale University, has recently been incorporated to make a comprehensive study of suicide as a social and psychological phenomenon. The following general outline has been adopted by the Committee: (1) intramural studies of individuals inclined to suicide in selected hospitals for mental diseases; (2) extramural studies of ambulatory cases with suicidal trends or with obsessional wishes for their own death; (3) social studies of suicide; (4) ethnological studies, that is, comprehensive investigation of suicide among primitive races; (5) historical studies.

Ministry of Agriculture Leaflets

FOUR advisory leaflets have recently been rewritten for the Ministry of Agriculture and Fisheries. No. 267, which replaces the former Leaflet No. 296, deals with "Potato Growing in Allotments and Gardens". The section on autumn preparation of soil directs attention to the importance of taking precautions against wireworms and leather jackets. It is not now recommended that seed be saved from a previous crop grown in the same district, owing to the depredations of virus disease, and the account of manuring is also brought into line with modern research. Advisory Leaflets No. 180, on "The Cultivation of Raspberries", and No. 268, on "Plums and Damsons", are revised mainly in the sections dealing with soils, diseases and manuring. The fourth Leaflet, No. 113, portrays, briefly, but with businesslike adequacy, modern methods of chicken rearing. The descriptions of sanitary considerations reflect modern research findings upon avian disease, the merits of the various systems of hovers and battery brooders are discussed, and the very considerable advances recently made in our knowledge of the food requirements of poultry are very evident in the section on feeding.

World Power Conference

IN accordance with the constitution of the World Power Conference, which states that the country in which a plenary meeting is held shall appoint the president, Mr. William F. Durand, chairman of the Third World Power Conference, has been appointed to serve until the next plenary meeting. Sir Harold Hartley has been re-elected chairman of the International Executive Council to hold office until the next plenary meeting, and the following have been elected vice-chairmen, to hold office for three years: *First Vice-Chairman:* Mr. O. C. Merrill (U.S.A.), director of the Third World Power Conference; *Second Vice-Chairman:* Mr. G. J. T. Bakker, president of the Royal Netherlands Institute of Engineers; *Third Vice-Chairman:* Dr. M. Kamo, professor in the Faculty of Engineering, Tokyo Imperial University. The Second Chemical Engineering Congress will be held in Berlin in 1940, by invitation of the German National Committee.

Books on Zoology

SEVERAL catalogues of books and periodicals dealing with aspects of biological science have recently appeared. Bernard Quaritch's general catalogue (No. 521) lists all classes of zoological works, to the number of 965. The most complete section is that dealing with entomology, in which is included a selection of books from the library of the late Robert Adkin. Another of Quaritch's catalogues (No. 524) contains two sections of books on early medicine and surgery, and on early science, in all 83 volumes, most of them belonging to the sixteenth, seventeenth and early eighteenth centuries. Messrs. Wheldon and Wesley's catalogue of books on ornithology (N.S. No. 43) is a useful bibliography of birds, listing 1,289 items, the majority of which are arranged geographically.

The Night Sky in October

BETWEEN October 1 and 31, the days shorten by $1^h\ 48^m$ in the southernmost part of the British Isles and by $2^h\ 47^m$ in the northernmost part. British Summer Time ends on Oct. $4^d\ 2^h$ U.T. The moon is new on Oct. $15^d\ 10{\cdot}3^h$, and full (the Hunter's Moon) on Oct. $30^d\ 6{\cdot}0^h$. Of the lunar occultations visible from Greenwich, the following may be noted: υ Tauri (mag. 4.4) on Oct. $4^d\ 20^h\ 43{\cdot}7^m$ as a reappearance: τ Tauri (mag. 4·3) on Oct. $5^d\ 3^h\ 2{\cdot}8^m$ as a disappearance and its subsequent re-appearance at $3^h\ 44^m$: A Tauri (mag. 4·5) on Oct. $31^d\ 21^h\ 56{\cdot}9^m$ as a disappearance and at $22^h\ 55{\cdot}7^m$ as a reappearance of the star. The planets visible during October are as follows: Mercury as a morning star at greatest west elongation on October 16: Venus as an evening star in gibbous phase; Jupiter as an evening star. Saturn is visible throughout the night; its ring system appears nearly closed, the minor axis being about 2″. The apparent paths of Uranus (stellar magnitude at opposition 6·0) and Neptune (mag. 7·7) are given in graphical form in the "Handbook" of the British Astronomical Association for 1936. On October 31, Uranus is in opposition, when its distance from the earth will be about 1,745 millions of miles. Mars is in conjunction with Neptune on October 25, when the former planet will be only

0·4° north of the latter. The light variations of Algol (R.A. $3^h\ 4^m$: Dec. 40° 43′ N.) may be observed at about the following times, which represent approximately the mid-epoch of diminished light : Oct. $1^d\ 19^h$, $16^d\ 3^h$, $19^d\ 0^h$, $21^d\ 21^h$ and $24^d\ 18^h$. A nova of the 8th magnitude at discovery on September 18 has been reported from Copenhagen, the discoverer being Mr. N. Tamm of Kvistaberg, Sweden. Its position in Aquila is R.A. $19^h\ 13^m\ 59{\cdot}5^s$: Dec. 1° 36′ 31″ N., not far from the 4th magnitude star, δ Aquilæ. The nova is fading, and on Sept. $23{\cdot}8^d$ was reported by Steavenson as being of magnitude 8·8. The comet discovered on September 20 by Mr. C. Jackson at the Union Observatory, Johannesburg, is in Aquarius, but it is very faint, and invisible except to large telescopes.

Announcements

It is announced in *The Times* that Convocation of the University of Cape Town has elected General Smuts as Chancellor of the University in succession to the King, who held that office while Prince of Wales but vacated it on his accession.

The Ramsay Memorial Fellowship Trustees have made the following awards of new fellowships for the year 1936–37 : Dr. E. D. Hughes, a British fellowship of £300, tenable for two years, Mr. R. R. Gordon, a Glasgow fellowship of £300, tenable for two years, and Dr. D. Porret, a Swiss fellowship of £300, all at University College, London. The Trustees have renewed the following fellowships for a second year : Dr. N. Ando (Japanese fellow), University College, London ; Mr. C. S. Lees (British fellow), University of Cambridge ; Dr. D. MacGillavry (Netherland fellow), University of Cambridge.

At a recent meeting the Association of German Röntgenologists and Radiologists in Czechoslovakia decided to found a Jaksch Prize on the occasion of the eightieth birthday of its president, Prof. Rudolf Jaksch Wartenhorst, to be awarded annually to young röntgenologists who have distinguished themselves by good scientific work.

The fourth European Congress of Mental Hygiene will be held at the Conference Hall, Ministry of Health, on October 5–8, when the following subjects will be discussed : mental hygiene and the cinema ; mental hygiene and the nurse ; and mental hygiene and the child from eleven to eighteen years. A reception will be given by the Government at Lancaster House on October 5 or 6, and visits will be paid on October 7 and 8 to various psychiatric hospitals, clinics and colonies. The official languages of the Congress will be English, French and German. Further information can be obtained from the Secretary, National Council for Mental Hygiene, Chandos House, Palmer Street, London, S.W.1.

In view of the many requests that have been received from those who attended the conference on mechanization in agriculture held in Oxford last January, it has been decided to hold a second conference at Rhodes House, Oxford, on January 5–8, 1937. A detailed programme will be sent in due course on application to the Conference Secretary, Institute for Research in Agricultural Engineering, Parks Road, Oxford.

Owing to the present condition of affairs in Spain, the third International Congress of Malaria, which was to have been held at Madrid on October 12, has been postponed, but it is hoped that it will take place in the spring or summer of 1937.

The sixth Italian Congress of Microbiology will be held at Milan in April 1937. Further information can be obtained from the secretariat, Via Darwin 20, Milan, 124.

Messrs. Francis Edwards, Ltd., have issued a useful catalogue on Africana (No. 602), which contains a long classified list including several scarce volumes and also a number of autograph letters of David Livingstone referring to his African work.

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

A civil engineer and a mechanical engineer in the War Department—Under-Secretary of State (C. 5), War Office, S.W.1, quoting "O.P." (October 7).

A lecturer in metal mining in the University of Birmingham—The Secretary (October 9).

A lecturer in electrical engineering at the County Technical College, Worksop—The Principal (October 10).

A male assistant (Grade II) for radio work in a Government establishment in the south of England—Secretary, Royal Engineer and Signals Board, Regent's Park Barracks, Albany Street, London, N.W.1 (October 17).

Temporary assistants (Grade III) at the Royal Aircraft Establishment, South Farnborough, Hants, for ballistic calculations — Chief Superintendent, quoting "No. A.233" (October 12).

A professor in ship design and shipbuilding at the Royal Technical College, Copenhagen—The King, Ministry of Education, Copenhagen, K (October 22).

A regius professor of pathology in the University of Aberdeen—Private Secretary, Scottish Office, Whitehall, S.W.1 (October 31).

A skilled scientific instrument maker at University College, Exeter—The Registrar.

Temporary heating assistants in the drawing office of the Works and Buildings Directorate, Air Ministry —The Secretary (W.B. 9), Air Ministry, Adastral House, Kingsway, W.C.2, by postcard.

Temporary assistants in the drawing office, Civil Engineer-in-Chief's Department, Admiralty—Civil Engineer-in-Chief, Admiralty, S.W.1, marked "Temporary Eng. Assts."

Unestablished assistants in the drawing offices at the Admiralty and H.M. Dockyards—Civil Engineer-in-Chief, Admiralty, S.W.1, marked "Grade III".

An examiner in the Aeronautical Inspection Directorate (A.I.D.) Test House, Cardington, Beds. (metallic materials section, micrographic subsection) —Secretary (S.2.d.), Air Ministry, Adastral House, Kingsway, W.C.2.

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. 591.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

Newton's Prism in the British Museum

A GLASS prism, said to have been the property of Isaac Newton, is on exhibition in the British Museum, Medieval Collections Room, Bay XVI. It was presented in 1927 by the Rev. H. T. Inman of Grantham, a collateral descendant of Newton, and resembles quite closely the prism seen in the hand of the statue of Newton in the ante-chapel of Trinity College, Cambridge. A question which naturally occurs to men of science who see this prism is whether it is one of those which Newton used in his famous experiments on the spectrum in 1666, described in his "Optical Lectures" of 1669, pp. 58 and 75, and reported also in *Phil. Trans.*, 6, 3075 (1671).

Since Newton gave fairly explicit data on the refracting angle and index of refraction of the principal prism which he used on this notable occasion, the question of the association of the British Museum prism with Newton's early experiments might lend itself to a ready answer. Newton states, in the course of the aforementioned references, that the prism which he principally used had as its greatest angle 63° 12′ and that its index of refraction for that portion of the spectrum "tending toward the middle of the green" was 17/11 (1·545).

This question had apparently not been explored until it was recently raised by me in a letter to NATURE. The letter was referred to the British Museum authorities, whereupon Mr. N. J. Plenderleith, head of the Research Department, caused measurements to be made upon the prism which had suggested the inquiry. The report, from which I am permitted to quote, contains the following statements :

". . . the characteristics differ markedly from those given by Newton in his paper (*Phil. Trans.*, 1671, Vol. 6, p. 3077).

	Newton's Famous Prism	B.M. Prism
Prism Angle	63° 12′ (max.)	60° ± ½°
Refractive Index (middle of the green)	1·545	1·5933 (5461)

The specific gravity of the B.M. prism is 3·36. . . . The final conclusion is that the prism mentioned by Newton, although undoubtedly a flint glass, cannot possibly be identical with that now preserved by the British Museum."

The question still remains whether or not the British Museum prism is one of those which, though mentioned in Newton's writings, played a less prominent part in his early researches and for which his data are less explicit. It is, possibly, scarcely worth while to investigate this point.

LLOYD W. TAYLOR.

Department of Physics,
Oberlin College Ohio.

Relationship between Post-Natal Coat Characters and Prenatal Follicle Density as Affected by Increase in Fœtal Size

A SERIES of New Zealand Romney fœtuses have been studied with the view of showing that there is a correlation between post-natal coat characters and pre-natal follicle density as affected by increase in fœtal size.

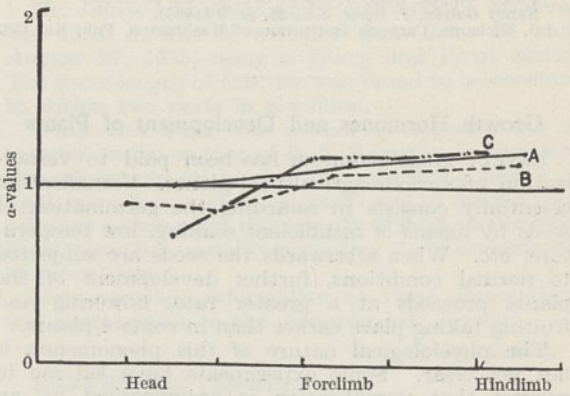

FIG. 1. Antero-posterior gradient in relative growth rate in length (*A*), width (*B*) and height (*C*) at 46–86 days.

It was found from the values of the equilibrium constant[1] α for the different body regions that there exists after the 42nd day stage an antero-posterior gradient in the fœtal relative growth rate for length, height and width. This gradient was slight up to the 80-days stage but was marked from 80 days until 127 days (Figs. 1 and 2).

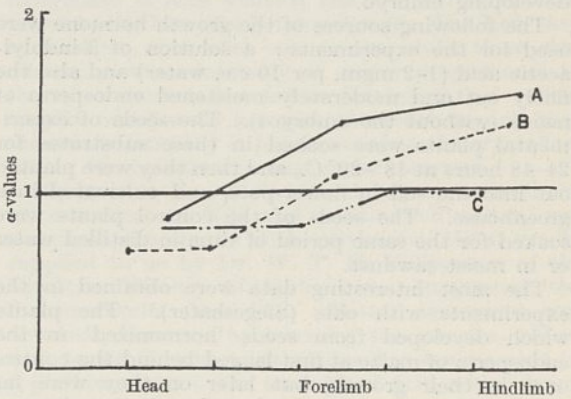

FIG. 2. Antero-posterior gradient in relative growth rate in length (*A*), width (*B*) and height (*C*) at 86–122 days.

This growth gradient was found to be comparable with the britch to poll fibre type array gradient[2]

found in the fleece of the lamb. Coarse fibred arrays occurred on regions which grew much more rapidly after the 80th day, that is, after the completion of the trio stage of follicle development[3].

From 'α-with-time' calculations[4] (the curves for which did not vary markedly from the α-curves) it was possible to demonstrate that changes in follicle density regions were associated with changes in the growth rate of that region. Further, from the curves it was shown that on regions with a large number of pre-curly tip fibres—for example, poll and neck regions—follicle initiation commenced when the growth rate of that region was at a maximum.

Full details are contained in my D.Sc. thesis for the University of Edinburgh, and will be published in the form of papers.

NANCY GALPIN.

Institute of Animal Genetics,
Edinburgh.
Royal Veterinary College,
London, N.W.1.

[1] J. S. Huxley and G. Teissier, NATURE, **137**, 780 (1936).
[2] Nancy Galpin, *Emp. J. Agric. Sci.*, **4**, No. 14 (1936).
[3] Nancy Galpin, *J. Agric. Sci.*, **25**, pt. 3 (1935).
[4] O. Richards, Carnegie Institution of Washington, Pub. No. 452.

Growth Hormones and Development of Plants

LATELY great attention has been paid to vernalization of various agricultural plants. Vernalization essentially consists in retarding the germination of seeds by means of insufficient soaking, low temperature, etc. When afterwards the seeds are subjected to normal conditions, further development of the plants proceeds at a greater rate, flowering and fruiting taking place earlier than in control plants.

The physiological nature of this phenomenon is not yet clear. Some experiments have led me to suggest that vernalization is accompanied by an increase of the concentration of growth hormone in the cells of the embryo[1].

This hypothesis suggested that it would be worth while to soak seeds in concentrated solutions of the growth hormone and examine the effect on the development of the plant. On the basis of previously published data[2] it was to be expected that in this case, at least in the Gramineæ, there would be an accumulation of the hormone in the tissues of the developing embryo.

The following sources of the growth hormone were used for the experiments: a solution of β-indolyl-acetic acid (1–2 mgm. per 10 c.c. water) and also the finely cut and moderately moistened endosperm of maize (without the embryos). The seeds of experimental plants were soaked in these substrates for 24–48 hours at 18°–20° C., and then they were planted out into the soil in flower-pots, and cultivated in a greenhouse. The seeds of the control plants were soaked for the same period of time in distilled water or in moist sawdust.

The most interesting data were obtained in the experiments with oats (Siegeshafer). The plants which developed from seeds 'hormonized' in the endosperm of maize at first lagged behind the control ones in their growth, but later on they were far ahead of them and bloomed twelve days earlier.

From the seeds of oats which were soaked in the β-indolyl-acetic acid, considerably stronger plants developed than from the control ones. Blooming took place simultaneously in both groups. The quantity of grain which was collected from the experimental plants (when calculated per plant) was greater than in the control ones by 55 per cent.

Thus we see that 'hormonization' of the seed before planting sometimes influences the further development of the plants and causes in some cases an acceleration of their development and a shortening of the vegetative period; in other cases a stimulation of growth, accompanied by an increased crop, is observed. It seems possible that treatment of seed by the concentrated solutions of various growth substances may find its application in agriculture.

N. G. CHOLODNY.

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Academy of Sciences,
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Aug. 10.

[1] *C.R. Acad. Sci. U.R.S.S.*, 1936 (in press).
[2] *Planta*, **23** (1935).

Divergent Physiological Effects of Synthetic and 'Natural' Ascorbic Acids

DEPENDING upon the concentration of the active substance, the effect of ascorbic acid upon the growth of seedlings may be either stimulatory or inhibitory. It has been noticed before[1,2] that, at a given concentration, the effects of the synthetic product and of the acid crystallized from a natural source were not identical. We have endeavoured to investigate the reason for the discrepancy.

Commercial synthetic ascorbic acid sold by British Drug Houses, Ltd., and the ascorbic acid isolated from paprika and kindly given by Prof. A. Szent-Györgyi, were compared. Pure-line Wilhelmina wheat, which we owe to the kindness of W. H. Parker of Cambridge, was germinated, after external sterilization, on filter paper in Petri dishes. 3–5 ml. of an aqueous solution of ascorbic acid was added daily to the Petri dishes, each containing 30 wheat seeds, aseptic precautions being used throughout. The experiment was concluded after 12–14 days, when the food reserves of the seeds were exhausted. The effects of substances intermediate in the synthesis were also tested. The accompanying table gives our results:

Substance	Concentration	Average length of one shoot (mm.)	Average weight of all shoots (gm.)
Ascorbic acid synthetic	5/1,000	49	0·70
Ascorbic acid natural	5/1,000	72	1·05
Ascorbic acid synthetic	1/1,000	66	1·08
Ascorbic acid natural	1/1,000	97	2·10
d-Glucose	5/1,000	104	1·84
d-Sorbite	5/1,000	80	1·48
l-Sorbose	5/1,000	68	1·25
Water (control)	—	90	1·95

The previously noticed inhibitory effect of natural ascorbic acid at a concentration of 5 in 1,000 has been confirmed. This inhibition is nevertheless much inferior to that produced by the synthetic product of the same concentration.

In previous experiments, natural ascorbic acid was found to exert optimal stimulation at a concentration of 1 in 10,000; from the above results, stimulation by the natural product can be discerned at 1 in 1,000,

at which concentration the synthetic substance still shows an inhibitory effect. These remarks do not rest solely upon the measurements cited, but also upon the general behaviour of the seedlings.

As the divergencies of action seemed to point to the presence of some impurity in the synthetic ascorbic acid, we recrystallized it from petrol-ether and methanol. Although incomplete, the results obtained with the material recrystallized from methanol suggest that some impurity was indeed present.

LÁSZLÓ HAVAS.
IMRE GÁL.

Hungarian Biological Research Institute,
Tihany.

[1] L. Havas, NATURE, **136**, 435 (Sept. 14, 1935).
[2] L. Havas, NATURE, **136**, 989 (Dec. 21, 1935).

Range of Action of Surface Forces

IN connexion with recent letters under the above heading[1], the following experiments may be of interest.

If two optically plane glass surfaces be worked into close contact, they seize with a force which varies inversely as the square of the distance between the plates[2]. Let rectangular plates be worked to about $1{\cdot}5 \times 10^{-5}$ cm. apart, as shown by the white of Newton's colours of thin plates. The tangential forces of seizure may then be about 100 gm. weight per sq. cm. If now a little water be applied round the edges, it creeps in between the plates, and they are forced apart by increase in the pressure of the trapped air. If the water be applied only at one of the straight edges, it creeps in at a varying rate: for horizontal plates the time t to travel a distance l is proportional to l^2. If, after all air has been forced out, the surplus water be removed from the edges with blotting paper until a narrow Newton-white border is seen all round, it will be found that the plates, with water between, seize with a force much greater than when air is between the plates. A tangential force as great as 1,700 gm. per sq. cm. has, in this way, been found to be borne apparently by a water layer $1{\cdot}5 \times 10^{-5}$ cm. thick.

This is, of course, no proof that the water layer was withstanding this great shear stress, since the glass surfaces were being held apart at the Newton-white distance by 'dirt' props, and since it is possible that the reduction in pressure within the water layer (due to surface tension at its edges) may distort the glass so that the surfaces are closer together in the water than the Newton-white distance observed at the border, and so give greater seizure in accordance with the approximate inverse square law.

It may be of further interest to point out that μ, the coefficient of viscosity of water, can be calculated approximately from its surface tension T, by timing the flow of water into the narrow gap. For a rectangular sheet of water, $\mu \doteqdot TDt/3l^2$, where D is the distance between the plates and t the time to flow in a length l. For a circular capillary tube, diameter d, $\mu \doteqdot Tdt/4l^2$. With a tube 0·036 cm. diameter, an experiment gave a good enough value for μ, namely, 0·010 c.g.s. at 16° C., but with plates about $2{\cdot}5 \times 10^{-5}$ cm. apart, μ came out at 0·11 c.g.s. Whether this high value has to be regarded as a genuine indication of increased viscosity in thin films or as an effect of 'dirt' props and of seizure forces it is hard to say. Sir Joseph Larmor[3] has recalled Kelvin's suggestion that there was experimental evidence of "a new type of intimate friction, entirely different from the smooth viscosity" of hydrodynamic theory.

JAMES M. MACAULAY.

Physical Laboratory,
Royal Technical College,
Glasgow.
Aug. 25.

[1] Derjaguin, NATURE, **138**, 330 (Aug. 22, 1936). Bowden and Bastow, NATURE, **135**, 828 (May 18, 1935).
[2] Macaulay, *J. Roy. Tech. Coll., Glasgow*, 1935, p. 353.
[3] Sir Joseph Larmor, NATURE, **138**, 74 (July 11, 1936).

Constancy of Wave-length of Light

THE recent correspondence in NATURE regarding the constancy of the velocity of light raises the auxiliary question as to the constancy of the wave-length of light. Experimentally, this is best approached by a study of the wave-length of a spectral line.

Mr. James L. Lawson and I continuously observed the 4358 A. line of mercury from June 24 until August 27, 1935, using a Fabry and Perot étalon. The wave-length of this line was found to be constant to within two parts in a million.

While this work was neither so accurate nor so comprehensive as that of R. J. Kennedy, it possessed the advantages of having the interfering beams of light travelling in identical paths and of having been taken at a time when the velocity of light should have been changing rapidly according to Edmundson's empirical law.

More complete information on these observations will soon appear in the *Astrophysical Journal*.

GUY C. OMER, JUN.

Blake Physical Laboratories,
University of Kansas.

Colloidal Silica in Natural Waters and the 'Silicomolybdate' Colour Test

IN the estimation of silica by the colorimetric method of Diénert and Wandenbulcke[1], the yellow colour produced by the addition of ammonium molybdate in acid solution has hitherto been attributed to the ions of a heteropolyacid. The fact, easy to establish, that silica sols do not, under these conditions, give an intensity of colour proportional to the silica present, has led to the belief that colloid micellæ of silica do not give the reaction, and that the colour intensity is proportional to the crystalloid silica. We believe this view to be incorrect.

We have made colorimetric determinations of the silica content of Nile and certain well-waters, and compared the results with gravimetric data, kindly supplied to us by Dr. W. T. H. Williamson of the Egyptian Ministry of Agriculture. In general, the former results were low. Better agreement was obtained, however, by warming the samples, before test, to 80° C. with a little silica-free caustic soda in a platinum vessel, the amount of acid added being correspondingly increased.

To see whether the colour intensity could be taken as an indication of the content of crystalloid silica, we tested the samples again after passage through Zsigmondy-Bachmann ultra-filters of different grades.

The reduction in the intensity of the colour afterwards produced was found to exceed by far the increase observed on peptizing with caustic soda, and amounted, with a 170-minute ultra-filter, to some 60 per cent. The liquid above the ultra-filter became correspondingly richer in silica as filtration proceeded, and since all sources of error—such as leakage, contamination, or the shifting of the equilibrium between ions and micellæ—would reduce the differences found, it follows that the silica in the waters examined was mainly colloidal. As silica, though a minor constituent of natural waters, is an important constituent of most deposits, this result is of some interest. In our experiments the water samples were filtered through ash-free paper before use, and waxed bottles were used for storage and transport.

Ultra-filtration experiments with the yellow 'silico-molybdate' solutions showed that the latter substance is in a higher state of aggregation than the parent silica, for passage through a relatively coarse 60-minute ultra-filter rendered them nearly colourless. This result raises doubt as to whether the coloured substance is a true heteropolyacid, like those formed by phosphoric and arsenic acids, and suggests that it may be an adsorption complex.

Experiments with a dilute dialysed Graham sol confirmed the above conclusions. The sol, containing 12 mgm. Si/litre, was passed through ultra-filters of different grades, and the molybdate test applied to the filtrates both with and without previous peptization with alkali. The results were as follows :

Ultrafilter	Apparent Si content by usual test (mgm./litre)	Apparent Si content after peptization (mgm./litre)
1 minute	1·3	12
11 minutes	1·1	7·5
63 minutes	<1·0	6·2
200 minutes	Difference indistinguishable and colour barely perceptible.	

It will be noted : (1) that the alkali treatment brought all the silica into reaction, (2) that the finest ultra-filters removed that portion of the silica which reacted without previous peptization, (3) that a 63-minute ultra-filter, though capable of rendering the yellow solution nearly colourless, yet allowed about half the silica to pass through.

With sodium metasilicate solutions, provided they were sufficiently dilute and the molybdate and acid added in sufficient quantity, the apparent silica contents as given by comparison of the colour with the buffered bichromate standards of Swank and Mellon[2] were found to be in fair agreement with the gravimetric determinations. But here also, owing to the addition of the acid necessary for the colour test, the silica which reacts with the molybdate appears to be mainly colloidal : for even with a slightly alkaline solution (*p*H 8·7, potentiometric determination) a 30 per cent reduction of silica content was effected by passage through a 250-minute ultra-filter.

From diffusion data Jander and Heukeshoven[3] conclude that silicic acid polymerizes rapidly when the *p*H falls below 10·9. Sea-water, though buffered at very much lower *p*H values, yet appears to exert a peptizing action, as the following experiment has shown : known volumes of a dilute Graham sol of known silica content were added to silica-poor sea-water, the quantities being such as to correspond to a silica-rich sea-water. Colorimetric tests were then made, both with and without the alkali treatment described. The former tests gave in each case the correct silica content ; the latter gave results ranging from 25 to 100 per cent of this, according to the age of the solution at the time the molybdate was added. We believe, in view of this result, that estimates of the total silica contents of sea-water by the method of Diénert and Wandenbulcke may be not widely in error, provided the silica has been held in solution for a sufficient period.

A. R. TOURKY.
D. H. BANGHAM.

Egyptian University,
Abbassia, Cairo.

[1] *C.R. Acad. Sci.*, **176**, 1487 (1923).
[2] *Ind. Eng. Chem., Anal. Ed.*, **6**, 384 (1934).
[3] *Z. anorg. Chem.*, **201**, 361 (1931).

Fermentation of Phosphogluconic Acid

IN their fundamental researches, Warburg and his co-workers[1] have described in detail the enzymatic oxidation of glucosemonophosphate to phosphogluconic acid. Furthermore, they found that the oxidation product is easily fermented by yeast macerate. Now, phosphogluconic acid might be a first product of carbohydrate oxidation occurring in a manner different from fermentative breakdown. Then the breakdown of phosphogluconic acid effected by yeast extract might represent a further step in the course of oxidation.

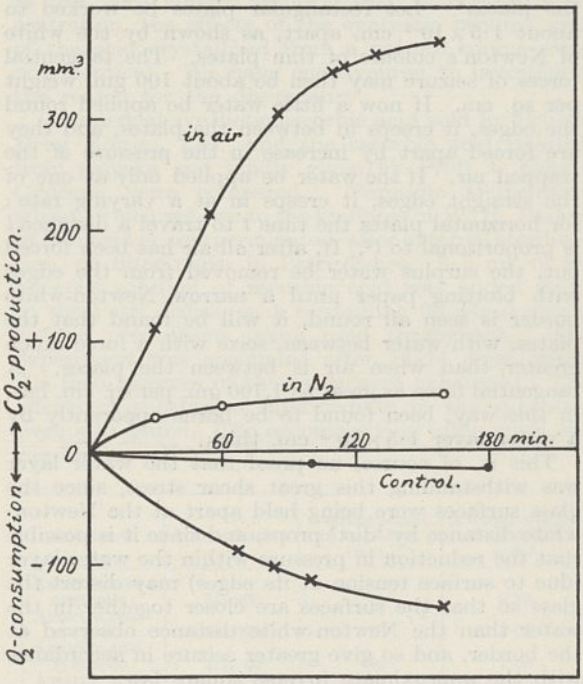

FIG. 1.

Studying this reaction, I found that, in the absence of oxygen, formation of carbon dioxide was very slow. The experiments of Warburg, Christian and Griese[1] mentioned above were done in air. According to my experiments carried out under similar conditions, the rapid formation of carbon dioxide in air was found to be accompanied by an absorption of oxygen ; per oxygen atom absorbed, 1·5–2 mol. of carbon dioxide appeared.

The experiment represented in Fig. 1 shows the ærobic and anærobic fermentation of 0·44 mgm. phosphogluconic acid–P, present in 0·5 c.c. of yeast

macerate. The acid was prepared from Robison ester by bromoxidation, after Robison and King[2]. Part of the experiments was done with an almost pure preparation, which was most kindly supplied to me by Prof. R. Robison.

Bromoacetate, in a concentration which would entirely inhibit alcoholic fermentation (0·01 mol.), inactivates only partly. The oxygen consumption is almost unaffected, but carbon dioxide formation is reduced. In this case, per oxygen atom consumed nearly one mol. of carbon dioxide appeared. This might indicate that a primary oxidation and decarboxylation, unaffected by bromoacetate, is followed by a reaction, which may be of fermentative nature. This explanation seems to be corroborated by the experiments of Bernhauer and Görlich[3] on the oxidation of gluconic acid effected by bacteria. They found α-ketogluconic acid as one of the oxidation products. If now in yeast extract phosphogluconic acid is oxidized primarily to phospho-α-ketogluconic acid by one atom of oxygen, this compound, being an α-ketoacid, would easily split off carbon dioxide, giving rise to arabinosephosphate. The quotient $O : CO_2 = 1$, found in the presence of bromoacetate, would thus find its explanation.

Fluoride inhibits both oxygen absorption and carbon dioxide formation somewhat more strongly than bromoacetate.

During the oxidative fermentation of phosphogluconic acid, none or only a small amount of the phosphate is split off.

FRITZ LIPMANN.
Biological Institute of the Carlsberg Foundation,
Copenhagen.

[1] Warburg, Christian und Griese, *Biochem. Z.*, **282**, 157 (1935).
[2] Robison and King, *Biochem. J.*, **25**, 323 (1931).
[3] Bernhauer und Görlich, *Biochem. Z.*, **280**, 367 (1935).

A New Strigeid Parasite of the Rare Genus *Cyathocotyle*

IN the course of my studies on the avian trematodes of India, a preliminary report on which, dealing with Strigeidæ and Echinostomidæ, has already appeared[1], one complete and one incomplete specimen of a new trematode were found which could not be included in the report above referred to. As the form is very interesting, a brief account of it is furnished here.

Cyathocotyle calvusi n.sp.

Body bulb-shaped, anteriorly swollen, posteriorly narrower; total length 2·06 (all measurements in millimetres on mounted specimens), maximum breadth 1·02, breadth of narrower region 0·038. Oral sucker 0·15 × 0·19, ovoidal or circular, subterminal; pharynx 0·09 × 0·097, nearly globular; cæca simple to near posterior end, broadly arched in front; œsophagus and prepharynx absent. Holdfast organ 0·32–0·4 in diameter, centrally located in globular part, outline irregular, overlapped by vitelline follicles along outer margin; wall covered with very peculiar characteristic, hair-like, fibrous outgrowths. Testes very conspicuous, much elongated; anterior 0·56 × 0·18, alongside holdfast organ; posterior 0·65 × 0·18, in narrower part of body, separated from the hind end by about half its length. Ovary roundish, 0·28 in diameter, masked by vitelline follicles, antero-lateral to hind testis. Vitellaria grouped in large follicles of irregular shape, along intestinal cæca meeting in front. Cirus sac 0·60 × 0·14, about one-third as long as body, posteriorly drawn out into a long neck; contains coiled seminal vesicle, surrounded by prostatic cells in anterior half, and a long tubular, eversible cirrus in its posterior half. Genital atrium short, with male and female ducts opening side by side into it; genital pore postero-terminal. Eggs about twice as long as thick, not many, 0·081–0·092 × 0·042–0·047. In intestine of King vulture, *Torgos calvus* (Scopoli), United Provinces.

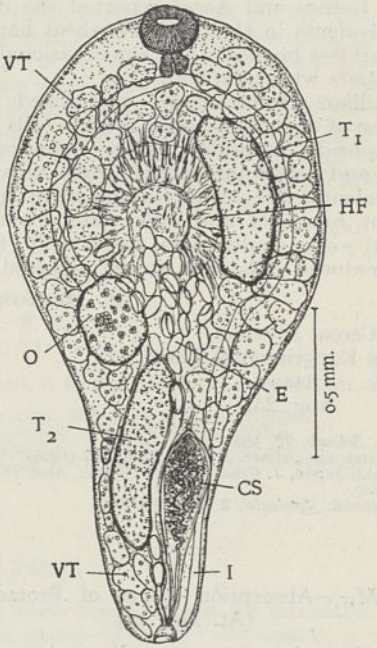

FIG. 1. *Cyathocotyle calvusi* n.sp. View of entire specimen.

Of the known species of the genus, the above worm is the largest, and stands somewhat close to *C. orientalis* Faust, 1921. But in addition to its larger size, it differs from it as well as from *C. prussica* Muehling, and *C. melanittæ* Yamaguti, in its body shape, in its much longer and differently placed testes, in the differing proportion of its cirrus to body length and in size and position of ovary and size of eggs. It would appear to be new to science.

S. C. VERMA.
University, Allahabad.
Aug. 8.

[1] *Allahabad Univ. Stud.*, **12**, 147–188 (1936).

Occurrence of Haploid Pollen Mother Cells in a *vulgare* Wheat

HAPLOID plants have been found in many species, but, so far as I am aware, there has been no recorded instance of haploid pollen mother cells occurring in a diploid plant. Bridges[1] has found patches of haploid tissue in *Drosophila*.

During an examination of smear preparations of the meiotic chromosomes in a seventh generation *H*44 × Reward wheat plant (*H*44 is a *vulgare* selection from the cross Yaroslav Emmer × Marquis), two 'haploid' pollen mother cells were found. One cell contained seven ring bivalents and seven univalents;

the other cell, one heteromorphic trivalent, one heteromorphic bivalent, one open bivalent, five ring bivalents and six univalents.

Apart from these two cells, each having a total of 21 chromosomes, all the other (320) cells on the slide appeared to have the normal number, 42, or thereabouts. The two cells (if none was lost) probably arose through pre-meiotic reduction. If such be the case, the pairing behaviour of the members of the genoms in the two cells is, to say the least, unexpected. Gaines and Aase[2] reported the occurrence of 0–3 bivalents in their *vulgare* wheat haploid, and Yamazaki[3] 0–4 bivalents and the occasional trivalent in his *vulgare* wheat haploid.

Dr. Lillian Hollingshead[4] mentioned the rare occurrence of aneuploid pollen mother cells in *vulgare* wheat hybrids, recording "clear instances of one bivalent and seven univalents, three bivalents and ten univalents, five bivalents and eight univalents, and eight bivalents and eight univalents". Such aneuploid cells could arise secondarily from pre-meiotic reduced cells such as are reported above.

R. MERTON LOVE.

Cereal Division,
Central Experimental Farm,
Ottawa.
Aug. 25.

[1] Bridges, *Science*, **72**, 405 (1930).
[2] Gaines and Aase, *Amer. J. Bot.*, 13, **6**, 373 (1926).
[3] Yamazaki, *Japan. J. Genet.*, **11**, 314 (1935); Abst. in *Der Zuchter*, **8**, 161 (1936).
[4] Hollingshead, *Cytologia*, **3**, 1, 119 (1932).

The $M_{IV,V}$-Absorption Edges of Protactinium (At. No. 91)

PROF. HAHN has put at our disposal a quantity of a protactinium preparation, which he has separated from Jáchymov pitchblende residues.

A spectrogram of the M_V-absorption edge of protactinium, showing clear secondary fine structure, is reproduced herewith. This structure has not been observed in the M-series hitherto. It has been obtained with the ionic tube for low tension[1] in connexion with the focusing method[2]. We have measured the M_V edge in the second order with reference to tungsten M-lines and obtained the values:

$$\lambda = 3601 \text{ X.U.} \quad \nu/R = 253{\cdot}1 \quad \sqrt{\nu/R} = 15{\cdot}91.$$

For the fine structure we find the following energy differences from the main edge:

(11) 16 35 51 76 volts.

In the position where the M_{IV} edge might be expected, we find an edge with similar fine structure to that of M_V, for which we have obtained:

$$\lambda = 3429 \text{ X.U.} \quad \nu/R = 265{\cdot}8 \quad \sqrt{\nu/R} = 16{\cdot}30.$$

The energy differences of the fine structure edges are:

5·4 17·5 23 36 volts.

By comparing the measured value $\nu/R = 265{\cdot}8$ with that interpolated for M_{IV} of the elements of atomic number 90 and 92, which is $\nu/R = 265{\cdot}1$, it appears, however, that there is a slight difference between them. This variance might have been caused by the fact that at the same position there appears also the K-absorption edge of potassium from the compound (K_2PaF_7). But we have not been able to find any trace of the edge precisely in the position of the interpolated value for M_{IV} and also we are unable, even after observing several spectrograms, to differentiate one from the other. So we are not in a position to decide whether this fine structure is of the M_{IV}-edge of protactinium or that of the K-edge of potassium.

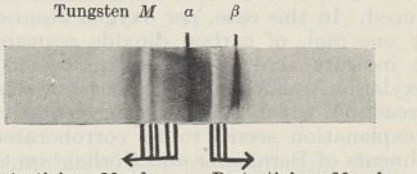

FIG. 1.

If we now compare the measured values of the M_V-edge with those calculated from the values, $M_V = L_{III} - L\alpha_1$, we obtain the following results[3]:

At. No.	M_V edge (measured)	M_V edge (calculated)	Diff. (meas.—cal.)
92	261·0	261·3	−0·3
91	253·1	253·6	−0·5
90	244·8	245·0	−0·2

From these results it can be seen that, within the limits of observation, there is no difference between the measured and the calculated energy values.

It has been shown[4] that there exists a systematic difference, which is about ν/R meas. $- \nu/R$ cal. $= +3$, between the directly measured energy values of the M_V and M_{IV}-edges of the elements from atomic number 83 downwards and their corresponding values calculated from the L-edges. But as our results testify, such a difference does not exist in the case of the highest three elements. It can also be shown from the above results that the same fact is valid for the M_{IV}-edges of the highest three elements.

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[1] V. Dolejšek, V. Kunzl, *Z. Phys.*, **74**, 565 (1932).
[2] V. Kunzl, *C.R. Acad. Sci.*, **201**, 656 (1935).
[3] V. Dolejšek und J. Marek, *Z. Phys.*, **97**, 70 (1935); J. Bačkovský und V. Dolejšek, *Z. Phys.*, **99**, 48 (1936).
[4] E. Lindberg, *Nova acta reg. soc. Upsala*, 1931; M. Siegbahn, *Z. Phys.*, **67**, 567 (1931).

Research and Teaching in Universities

I CANNOT pass unchallenged the remark quoted from Dr. R. Coulborn's article in the *Nineteenth Century* of July in NATURE of August 22 (p. 304), namely, "the numbing influence of research upon character". This is surely not only untrue but also dangerous. In my experience, the contact with a research problem has proved to be a fine training for a young man, as it provides just the stimulus needed to convert his mind from the text-book outlook upon life to the realities. If it be 'numbing' to teach him proper humility and the scope of his actual knowledge, then let us have more of such refrigeration. Of course, he is not so likely to deal comfortably in

future with the vague and foggy generalities which so often pass for a wide humanistic outlook. Any professionalism is narrowing in the wrong hands.

Surely few things are better for redressing the dangers of specialization in research than teaching. It is true that some teachers are bad research workers, and some research workers bad exponents; but it is my opinion that we do not want now a further separation of teaching and research; rather we should encourage our leaders of the future to aim at the higher ideal of serving both with efficiency. It is the harder path; but it could be made more possible if university and other authorities were reasonable in their teaching demands, and relieved their men of the really soul-destroying work, the endless board meetings and administrative checks.

By the above, I do not mean that encouragement should not be given to the development of the research institute under the right direction; but I think that sufficient research funds should also be in the *independent* hands of universities in Great Britain. This would enable them to support adequately by efficient technical assistance and otherwise their own research enterprises, which so will form a nursery for new ideas and the kind of lively stimulus required by the rising generation.

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The 'Specific Action' of Ultra Short Wireless Waves

IN a recent issue of NATURE[1] there appeared a criticism by Prof. W. E. Curtis, Dr. F. Dickens and Mr. S. F. Evans of this topic. These authors mention experiments on tumour metabolism *in vitro* and state that the results claimed by Dr. Reiter[2] are due to heat, adequate precautions against this not having been taken by him. One of us had already come to the same conclusion and published[3] his results on the growth of rat tumours *in vivo*. Furthermore, in a subsequent paper[4] he had shown that there is no sudden change in dielectric constant of tumour tissue at 3·4 m. as might be expected if Dr. Reiter's observations were correct.

We had further shown and published[5] the fact that the frog heart, cilia and muscle, when exposed in a field of ultra high frequency, are affected only when the temperature rose to that level which is known to cause arrest of physiological action.

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[1] W. E. Curtis, F. Dickens and S. F. Evans, NATURE, **138**, 63 (July 11, 1936).
[2] T. Reiter, *Deut. Med. Woch.*, **59**, 1497 (1933).
[3] H. J. Taylor, *Brit. J. Radiol.*, **8**, No. 95, 718.
[4] H. J. Taylor, *Brit. J. Radiol.*, **9**, No. 103, 467.
[5] L. Hill and H. J. Taylor, *Lancet*, Feb. 8, 1936, p. 311.

Points from Foregoing Letters

MEASUREMENTS of the refractive index and the angle of a glass prism on exhibition in the British Museum, said to have been the property of Isaac Newton, show that, while it may have belonged to him, it is not the one to which he referred in connexion with his famous experiments on the spectrum.

The coat characters of New Zealand Romney sheep in relation to the density of hair follicles on different parts of the fœtus at various stages of growth are discussed by Dr. Nancy Galpin, who states that changes in follicle density in a given region are associated with changes in growth-rate.

Oats soaked in a solution of a growth promoting substance previous to planting produced stronger plants and 55 per cent more grain than untreated seeds, according to Prof. N. G. Cholodny.

From experiments on wheat seedlings it appears that natural ascorbic acid (vitamin C extracted from paprika) exerts an optimal stimulation of growth at a concentration of 1 : 10,000. László Havas and Imre Gál report that the beneficial effect is still observed at a concentration of 1 : 1,000, but when the concentration is increased to 1 : 200 there is an inhibitory effect. With synthetic ascorbic acid the inhibitory effect appears at a concentration of 1 : 1,000, and the authors believe that it is due to an impurity.

Experiments are reported by Dr. J. M. Macaulay which show that, if water is allowed to creep in from one edge of a rectangular glass plate which is held by seizure forces to another glass plate distant from it $1{\cdot}5 \times 10^{-5}$ cm., the shear strength of the interspace is increased from about 100 gm. to 1,700 gm. per sq. cm., provided there is no surplus water round the edges. By observing the time for the water to creep in between plates ($2{\cdot}5 \times 10^{-5}$ cm. apart), a value for the coefficient of viscosity of the water film is calculated and found to be about ten times the normal value for water.

In connexion with the problem of the constancy of the velocity of light, G. C. Omer, jun. and J. L. Lawson have kept under observation for four weeks the mercury line of wave-length 4358 A., and found it constant within two parts per million.

It has been stated that in the colorimetric determination of silica with ammonium molybdate in acid solution, only the molecularly disperse ('crystalloid') silica reacts. From experiments with silica sols which have been ultra-filtered, treated with alkali, etc., Dr. A. R. Tourky and Prof. D. H. Bangham conclude that the silica which reacts with the molybdate is mainly colloidal. The reaction, however, gives approximately correct results provided the silica has been held in solution for a sufficient period.

Graphs showing the rate of oxidation of phosphogluconic acid (in yeast macerate), in presence and in absence of oxygen, are given by F. Lipmann. In the absence of oxygen the formation of carbon dioxide is very slow. The behaviour in presence of bromoacetate suggests that a primary oxidation and decarboxylation is followed by a reaction which may be of a fermentative nature.

Dr. R. M. Love records the occurrence of two haploid pollen mother cells, amongst some 320 normal diploid cells, obtained from one flower of a seventh generation hybrid wheat, which suggests that reduction of chromosome number has occurred in the division preceding normal meiosis.

Research Items

Early Iron in Egypt

MR. CHRISTOPHER HAWKES contributes to *Antiquity* of September a note on the content of two pieces of iron, one from the Great Pyramid (Fourth Dynasty, *c.* 2900 B.C.) and one from Abydos (Sixth Dynasty, *c.* 2500 B.C.), constituting the two major items of evidence for the use of iron in Egypt before the New Kingdom, to which Mr. G. A. Wainwright referred in his article "The Coming of Iron" in *Antiquity* of March last (see NATURE, **137**, 584). It has been shown, Mr. Hawkes now points out, by tests made by Dr. H. J. Plenderleith in the British Museum laboratory in 1926 and repeated in 1932, that the Pyramid piece affords no trace of nickel, and that, although minute traces of nickel were present in two samples from the Abydos piece, these are in samples taken from the outer rust, and no nickel appears in the core. Since all meteoric iron known has been found to contain nickel, it is a reasonable inference that neither of these two pieces is of meteoric origin. Even if the date of the Pyramid specimen is doubtful, as some have maintained, though a later origin seems improbable, there can be no question about the piece from Abydos. Further, Mr. Hawkes, on submitting his material and his conclusions to Dr. C. H. Desch, was informed by him that not only was he satisfied with the result, and accepted the view that the nickel in the Abydos samples of rust was in all probability derived from the associated copper, but he also referred to further specimens of early iron "which is certainly not meteoric" lately received by him from sites in Syria and Mesopotamia. Mr. Hawkes is, therefore, of the opinion that these pieces may be taken as evidence for the occasional smelting of terrestrial iron in the Near East as early as the third millennium B.C.

The Food of Australian Birds

IN a series of articles (*Emu*, **24**–**35**) the late A. M. Lea and J. T. Gray present a great mass of data on the food of Australian birds, based on analyses of stomach contents of 1,708 individuals covering 301 bird species. The results are classified into several main groups, such as: insects—destructive, and useful; seeds and vegetable matter; miscellaneous; and shells. Whenever possible, more detailed determinations of food items are given, while in an appendix all non-vegetable foods are classified in some detail, with lists of birds feeding on them. Although no discussion of the results is presented, the data provide ample material for judging the economic status of any given bird, as well as the relative liability of various animal groups to bird attack. In this connexion, a very high percentage of records of Rhynchota and Hymenoptera, both considered well 'protected', is worthy of notice.

Fauna of Sussex

INTERESTING records and comments upon the birds and butterflies of east Sussex, by N. F. Ticehurst, Capt. T. Dannreuther and others, appear in the *Hastings and East Sussex Naturalist* (**5**, 120, 157, Aug. 1936). Among the former the occurrence of Sykes's wagtail is discussed, and while it appears to be certain that birds with the characteristics of *Motacilla flava beema* have been seen on several occasions and have bred in the area, the suggestion that the colour variety may not be a true geographical race seems a likely one.

Pseudodiaptomus from South America

THREE species of this copepod genus are already known from South America. Mr. Stillman Wright adds a new one and describes the relationships, distribution and habitat of all four ("A Revision of the South American Species of *Pseudodiaptomus*", *Annaes da Academia Brasileira de Sciencias*, Rio de Janeiro, **8**, No. 1; 1936). These calanoids are interesting, for the group seems to be in the process of migration from salt to fresh-water; it is widely distributed and some of the species are apparently restricted to small and nearly inaccessible areas; therefore little is known about them. The South American species are found in water of different salinities; thus, as Dahl has previously pointed out, *P. gracilis*, appeared only in the sample farthest from the sea, in practically fresh-water, and was associated with *P. richardi*. The latter species was the only one represented in slightly more saline water, whilst in waters still more saline *P. richardi* was replaced by *P. acutus*, and this in turn disappeared in sea-water. Apparently the new species, *P. marshi*, taken in the estuary of Rio Capibaribe at Recife, Pernambuco, in Bahia de São Marco at São Luiz, Maranbrao and in the estuary of Rio Jagurabe at Aracatz, Ceará, is adapted to somewhat more salty water than *P. richardi*. So far as is known, none of the South American species lives in the sea.

Mosquitoes of the Ethiopian Region

DURING the last twenty-five years or so, knowledge of mosquitoes has increased to a manifold degree—not only with respect to their relations to disease transmission but also as regards their structure and biology. This vast amount of new information is scattered through many periodicals and, in such a form, it obviously lacks co-ordination. The Trustees of the British Museum (Natural History) have, therefore, taken a step to meet this difficulty in deciding to publish a three volume monograph on the mosquitoes of the Ethiopian Region, that is, of African south of the Sahara. Part I of this work appeared in April 1936, and deals with the general ecology of mosquitoes together with the taxonomy of the larvæ belonging to the Culicine series. Its author, Mr. G. H. E. Hopkins, has spent some years in mosquito survey work in Uganda, which well qualifies him for this task. The present contribution, which runs to 250 pp., is profusely illustrated with excellent text-figures showing the chief diagnostic characters of the larvæ of the different species. The study of the morphology and classification of mosquito larvæ has progressed alongside that of the adults. The advantages of such investigations are obvious since they enable rapid determination of species to be made without the labour of rearing them to the perfect insect—a process not always successfully

achieved. At the present day, therefore, knowledge of mosquitoes in the larval stage is as important as a proper acquaintance with the adults. Furthermore, an important aspect of mosquito control is eradication of the larvæ, which in its turn is founded upon a thorough knowledge of their specific habits and breeding places. In the present work these aspects of the work are dealt with as adequately as possible. It is stated in the preface that the other two sections of this work are nearing completion and will be issued next year.

Oil Treatment for Uneven Blossoming

THE influence of climatic factors during the winter months on the crop of fruit trees is examined by O. S. H. Reinecke (*J. Pom. and Hort. Sci.*, **14**, 2, 164; 1936) with special reference to South African temperature conditions. Data are presented for prunes and pears which show that when the winter maxima temperatures were high, the crop was poor, and conversely, low winter maxima were associated with abundant yields. The critical temperature appears to be near 64·5° F. Certain varieties of peaches, plums, pears and apples subject to high winter temperature and a shortened dormancy period suffer from 'delayed foliation' and a protracted blossoming period which results in fruits of irregular size and also makes pest control very difficult. Successful attempts to induce even blossoming in these conditions by artificial means are described by M. W. Black (*ibid.*, 175). Apple and pear trees sprayed about four weeks before blossoming with raw linseed oil emulsion, seal oil or certain mineral oil emulsions, produced an earlier, more prolific and more even bloom, whilst fewer leaf buds remained dormant, resulting in the formation of more spurs and shoots. Varieties most susceptible to conditions favouring 'delayed foliation' responded most readily, and the response was more marked after abnormal winters conducive to this disorder. The crop of Bon Chrétien pears was considerably increased as a result of the more normal blossoming, fruit quality, especially the storage properties of the fruit, was enhanced, and the bearing capacity of the tree was increased, due to more fruit buds being differentiated on both spurs and shoots. The oil spray treatment promises to be of great value to commercial growers by virtue of its beneficial effects on fruit production and tree growth in general, whilst the insecticidal properties of some of the mineral oils may be utilized simultaneously.

Soviet Arctic Stations

IN recent years the number of Soviet Arctic observatories, as a rule functioning throughout the year, has been steadily increasing, and now they number no less than seventy-seven. In an article on hydrographic surveys along the northern shores of the Soviet Union in the *Polar Record* for July, Prof. J. Schokalsky gives some account of the institution of these stations. The movement began in 1923 with the erection of a station on Matochkin Shar, Novaya Zemlya. There are now 14 stations on the Barents Sea, 26 on the Kara Sea, 19 on the Laptev Sea, 7 on the Eastern Siberian Sea, 6 on the Chukhotsk Sea and 5 on the Bering Sea. Of the total, 5 are magnetic-meteorological observatories, 28 are first-order stations with registering instruments, 24 take eye-readings only and 11 record observations only three times a day. All stations take observations of ice movements and all have radio-telegraphy. At many of the stations high-altitude observations are regularly taken. The Soviet Union has instituted a special school to train observers for these stations. Each observer as a rule spends only one year in an arctic station.

Viscometry

THE demands made by industry in Germany for accurate standardization of technical viscometers has led the Reichsanstalt to construct an absolute viscometer for the determination of the viscosities at different temperatures of a series of mineral oils which change little with time; these can be used for the standardization of industrial viscometers. The apparatus has been described by Drs. S. Erk and A. Schmidt (*Phys. Z.*, July 15). The liquid is forced by air pressure in succession through two capillary tubes of the same diameter, one short and the other long, which connect three metal cylinders of 4–5 cm. diameter, from which vertical glass tubes ascend to serve as manometers. The pressures are read by cathetometer and their differences for the long and short tubes enable the end effects to be eliminated. The apparatus is immersed in a bath at constant temperature with the capillary tubes horizontal. It has been found that carefully selected tubes drawn in the ordinary way have smoother internal surfaces and are more suitable than tubes formed in the plastic state about a mandril. To facilitate change of capillary tubes their connexions to the metal tubes are made by pipe unions which screw against perforated steel spheres cemented to the capillaries close to their ends. The capillaries are calibrated by mercury threads. An accuracy of 0·2 per cent for the viscosity is attained.

A New Insulating Material

WE learn from the September 13 issue of *Helios*, the electrical trade journal published in Leipzig, that the scarcity of raw materials in Germany has stimulated research for home materials having like or similar qualities. This has sometimes led to the discovery of new materials which are not only better but also possess new and valuable qualities. For example, it has occurred quite recently in the case of insulating tubes, for which supplies of cotton and oil varnishes have to be obtained from foreign countries. A new material called 'isyntha' has been developed which constitutes an excellent material for insulating tubes and wires. Tubes made from this material are free from woven layers and seams and are almost perfectly homogeneous. It is fireproof and is not affected by acids or oils. When tested with a suitable oscillating crank gear testing machine it was only after five hours, when more than a million bends had been made, that a crack appeared. Heating to a temperature of 78° C. for a period of 30 days caused no change in the material. Similarly, it withstood immersion in various acids and in a solution of caustic soda without showing any external change or loss of weight. At a temperature of − 18° C. a tube, which had been roved round a cylindrical rod five times its diameter, showed no signs of breakage or splintering. There are many possibilities of usefulness for isyntha tubes in electrical and radio engineering. Wires covered with it are procurable. The material can be stripped off the wires very easily and is puncture-proof for very high voltages.

Cultural and Social Values of Science*

SIR RICHARD GREGORY, BT., F.R.S.

IT is difficult to define 'cultural value'; for there are many different standards by which it is measured. The term is often used to signify acquaintance with classical languages and literature, but a better view is that learning, whether classical or not, is comprised of many parts and that culture is the one indivisible whole made up of them. When science is taught, not as an aid to a vocation, but as part of the training of a modern citizen, it may justly be claimed to have a cultural value. The purpose of scientific study is to discover the truth about all things, including man, his instincts and impulses, his organization in society. The habit of mind developed by this disinterested pursuit may be as effective an ethical agency as that usually associated only with studies of what are called the humanities.

Cultural and social values are, however, rarely implied in the study of science, but with that of literature, history and other subjects believed to be of a more humane type. Even among scientific workers themselves, there are many who are content to regard experimental and observational inquiries as belonging particularly to the natural sciences, and are indifferent to the application of scientific methods to the investigation of social problems or the influence of scientific knowledge upon human thought. Recognition of interrelationships between all departments of learning is, however, becoming more common than it was a generation or so ago : and the forces which were formerly engaged in conflicts between science and religion or science and classics now profess joint interest in the cultivation of all fields of human enlightenment.

Science and literature, or what are called the humanities, are not now regarded by responsible authorities as opposing elements in education. The two terms should be considered as synonymous ; for science rightly conceived is modern humanism in the fullest sense. Even if the humanities are understood to mean letters, history and art, there should be no conflict between these studies and natural knowledge.

But though scientific workers know well enough how science touches art and music, how it may enter into literature and how it makes history, there is not like appreciation of science from representatives of those schools of thought and teaching. It cannot be said that the intellectual horizon of men of letters of our own times has been extended by advances in modern science. There is not much evidence in the works of leaders of literature of assimilation of the new knowledge, or even of sympathy with it. Occasionally one finds a reasonable attitude towards the age of science and invention in which we live, but more usually there is an absence of an outlook which will regard science not merely as a storehouse of facts to be used for material purposes, but as one of the great human endowments to be ranked with art and religion and the guide and expression of man's fearless quest for truth.

The influence of science upon material progress and human comfort is understood much more commonly than that of its effect upon the human mind. It is difficult for people of these times to realize the liberation of life and intellect brought about by the works of Copernicus, Galileo, Vesalius and other pioneers of scientific learning. The very foundations of belief were shaken when it was shown that the abode of man was not the centre of the universe but only a minor member of a group of planets revolving around a sun which was itself only one of many thousands of suns in stellar space. When Newton had shown that his law of gravitation was sufficient to account not only for the movements of the planets but also for the paths of the comets, it was no longer reasonable to believe that they were sent as signs or warnings to the human race. Consider the tremendous revolution involved in this substitution of permanent natural law for the conception of a world in which all events were believed to be reflections of the moods of a benign or angry God.

The sense of justice which resulted from the knowledge of the existence and permanence of law in Nature profoundly influenced human thought, and resulted in social changes which had the greatest civilizing effects.

Just as Copernicus deposed the earth from the position it was supposed to occupy in the universe, so Darwin placed man in a new relationship to the rest of living creatures. Science is concerned with the progress of knowledge and the evolution of man not only in the past but also in the present and future. We need not believe that man has degenerated from a state of perfect knowledge to that of being "born in sin and shapen in iniquity", or that the recovery of his lost position must be looked for not in this world but in the next. The adoption of this depressing doctrine is opposed to evolution as a whole and subservient to all progress. Unlike the creatures of the field, man can make his own environment and so promote the development of any type he desires to survive. The social heritage to which he succeeds has an important influence upon his thoughts and conduct, but he himself can exalt or degrade it.

The advance of science in modern times has had supreme social value in the alleviation of human suffering and increase in the capacities and facilities for human happiness. As whatever subjects are defined as cultural or humanistic must be understood as being concerned with the welfare of man, the conquest of disease as the result of scientific research may rightly claim a high place among them.

Progress in physics and chemistry has profoundly altered those social conditions which it is the purpose of social science to study. The immense increase in the productive capacity of mankind is forcing society to consider the human consequences of the unlimited resources now at its disposal.

Scientific methods applied to the fields of politics, human biology, sociology, economics and psychology will enable facts to be ascertained and assembled for consideration by minds free from passion and prejudice, but knowledge of history and insight into human nature will be required to arrive at sound conclusions and construct practicable policies upon them.

* From contributions, made in the order here printed, to a discussion in Section L (Educational Science) of the British Association at Blackpool on September 10.

In recent years, leading representatives of science have warned the world of the disastrous consequences which must ensue unless the gap is lessened between scientific advance and moral or ethical development in both national and international spheres. Unless science repudiates the methods of cultivated barbarism involved in modern warfare, it must lose whatever right it now possesses to be a spiritual influence and acknowledge with despair that man's ethical evolution has already reached its culminating point. Such an end cannot, however, be contemplated, and it will be avoided by conserving social and spiritual values with scientific teaching and research. With this unity of intention it will be possible to hope for and expect scientific guidance of human growth not only towards individual fitness but also towards a higher human perfection.

PROF. LANCELOT HOGBEN, F.R.S.

We all know what is meant by the vocational aspect of education, and we wrongly assume that there is equally general agreement about the meaning of its cultural side. In theory, the word cultural commonly covers two entirely different functions of an educational system. One is the private problem of helping the individual to discover for himself or herself congenial sources of enjoyment to occupy leisure in after life with the fullest allowance for variety of temperament. The other is the public business of equipping individuals with the knowledge necessary for the discharge of their mutual responsibilities as co-citizens of a democratic society without regard to the personal inclinations of the child. In practice, what is called cultural education is neither the one nor the other. Good taste, which is synonymous with ostentatious refinement appropriate to a leisured class, takes precedence over the cultivation of individual satisfaction of temperamental needs, while political rationalizations of a bygone age exclude the study of resources for welfare which a modern community can use or abuse.

Increasing specialization and expanding outlets of vocational choice for individuals with a native inclination or aptitude for scientific studies must progressively limit the appeal of science as an active hobby. Meanwhile the demand of popular educational movements like the W.E.A. is for information about the social problems of our time. That science should be taught, because it teaches children to be observant and curious, is a dubious proposition. The case for science as an essential part of the education of the average man or woman does not rest on gratuitous assumptions about the transfer values of particular disciplines, or on the individual satisfaction which a small class of individuals may derive from verbal disquisitions on the latest, least digested discoveries at the periphery of theoretical research. The cultural claims of science rest on the social fact that the use and misuse of science intimately affects the everyday life of every citizen in a modern community.

While it is happily true that educationists are ahead of the scientific specialist in so far as the cultural teaching of science demands emphasis on its place in everyday life, the claims of science in the education of the citizen extend far beyond a passing familiarity with the way in which society at present uses the knowledge available for the advancement of human well-being. What is far more important is a recognition of the potential of human welfare inherent in scientific knowledge, which existing social machinery fails to exploit for the common weal. Even this neglected aspect of the problem which confronts us in designing a general course of science to take its place in the curriculum of humanistic studies does not exhaust all the issues which should claim pre-eminence. Others emerge more clearly, if we consider the dangers with which the preservation of democracy is now faced. One is failure to anticipate the dire penalties we may pay for the misuse of science. Complacent acceptance of its prostitution to destructive ends, and ignorance of the constructive alternatives which existing knowledge places at our disposal, will have disastrous consequences for all of us, if the helplessness and horror of modern war is canalized in a revolt against science, a repudiation of the benefits which science can confer and a retreat to a lower level of civilized living.

In contradistinction to purely static emphasis on the place of science in everyday life to-day, education for citizenship demands a knowledge of how science is misused, how we fail to make the fullest use of science for our social well-being, and, in short, a vision of what human life could be, if we planned all our resources intelligently. It calls for understanding of the way in which social agencies foster new discoveries and their useful application. In addition, it must reinforce confidence in rational endeavour by emphasizing the role of advancing scientific knowledge in the growth of social institutions.

A course of general science adapted to the requirements of citizenship should be orientated towards the elucidation of the major constructive achievements of natural knowledge in the evolution of civilization. Among the cardinal themes which thus replace the arbitrary division of science into separate 'ologies', those which claim special attention are the construction of the calendar, the technique of navigation and map making, the extension of deep-shaft mining and exhaustion of fuel supplies, the introduction of inanimate and mobile power, the discovery of chemical fertilizers and the principles of scientific breeding, the control of epidemic diseases and the national dietetic minimum. School science should not be a selection from the competing claims of specialist disciplines. It should be the story of man's conquest of time reckoning and space measurement, of the search for materials and substitutes, the liberation of natural sources of power and the struggle against hunger and disease. When it becomes this, the theoretical principles which have the greatest yield will emerge far more clearly, and there will be less reason for disagreeing about the relative importance of different aspects of scientific knowledge.

The indifference of men of science and educationists in the universities has relinquished one unique opportunity for implementing the cultural claims of science. It was offered shortly after the late European war, when the Civil Service Commission made a paper on *Everyday Science* compulsory for all candidates at examinations for higher grades. Provision of special instruction for such candidates, mainly drawn from the ranks of graduates who specialize in linguistic and historical disciplines, might have become a nucleus for the training of teachers for general science as a cultural subject. The examination proved to be a farce, presumably because no such provision was made until last year, when the Commissioners took the retrograde, if comprehensible, course of omitting *Everyday Science*

from the list of compulsory papers. The only official recognition of the need for scientific knowledge in the administration of the nation's affairs was thus withdrawn. Such decisions are not necessarily irrevocable, and it is still possible to bring the pressure of public opinion to bear on the Civil Service Commission. If it can be persuaded to reconsider the matter, the British Association would perform a useful service by appointing a joint committee of educationists and men of science to draw up a syllabus of instruction, and urge the universities to provide it.

Whether science will take its needful place in the instruction of the citizen and statesman depends far less on the attitude of the scientific specialist than on that of the educationist. The scientific specialist is too much immersed in his work and too much imbued with an attitude of social indifference generated by a long period of comparative prosperity and security to take an active part in the educational reformation which the present crisis in democratic societies calls for. The problems of the post-War world demand nothing short of a transvaluation of all educational values. Over-specialization is one of the great obstacles to their solution. If the educationist is to make a constructive contribution to the social problems of the present time, he will have to forfeit the luxury of false modesty in his dealings with the claims of specialists.

SIR A. D. HALL, K.C.B., F.R.S.

The true aim of science is the enrichment of life. Through science man obtains an increasing control over the operations of Nature and the blind forces which limit his activities.

It is commonplace to enumerate the gifts of science to humanity during the last century, such as the speeding-up and extension of communications by steamboat, railway, motor-car and aeroplane. Science gives us new sources of light and heat in our households, unwonted textiles for our clothing, healthier and more attractive food. Science is minimizing the curse of Adam—manual toil. At one time a man required a week to dig an acre; the horse plough enabled him to do it in little more than a day, the modern tractor will make light of it in an hour.

Such gains may be dismissed as material only, but science has equally contributed to our spiritual enrichment. Consider only the enlargement of our knowledge of the world and of the appreciation of history that easy travel has brought, or the contacts with art that photography has made possible. The gramophone has brought the whole range of music within the reach of the ordinary man. Wireless is contributing to the mark of the educated man—that awareness of what is moving in the minds of men.

Yet only a few years ago in a sermon to the British Association, Bishop Burroughs appealed for a ten years' vacation for science. Science is beginning to take on the aspect of an enemy, frustrating the enjoyment of all the advantages it can offer. Science is regarded as dangerous because at the same time as it is conferring the powers of production, people at large are learning of these powers and beginning to ask why they cannot enjoy their fruits.

Science means power, but it has given no consideration to whom that power should be entrusted and to what ends it should be used. The acceleration of productive power has led to over-production and unemployment; the sudden development of a new invention may throw another town into long-continued distress and poverty. The new developments of war methods by science are putting appalling powers of destruction into the hands of Governments.

The greatest of all dangers lies in the temptation that is now offered to the power-mongers. Once having obtained control of the machinery they can wipe out any further exercise of the popular will. Of old, every autocracy ended in revolution; What chance has a rising to-day against guns and gas? Moreover, a subtler technique has been evolved, not merely to control the people by force but also to subdue their minds until they will to be slaves. We are learning how the robot can be created by a Government controlling the Press and all publications, closing the frontiers to all communications, using the wireless and education as instruments of propaganda. The old reformers fought for universal education; Did they ever consider how it would be used to consolidate a tyranny? It is reported that the Germans are moving towards uniformity by the sterilization of the dissidents. The end is the ant community of soldiers and obedient workers.

Putting aside the fundamental question of whether the fruits of science can be enjoyed by the whole community or only by the few, how far can the knowledge of science be shared? It is a common reproach that people are using science without understanding—they press a button or turn a switch. This is no valid reproach; science is for the specialists, but general science should be the basis of education for all, and in this lies the only hope for the future. The specific value of education on a basis of science is that it will encourage if not create a habit of acting on reason rather than emotion. One may recognize that emotion is the spring of action and yet realize that reason can exercise some control.

Party, Country, Religion—these are the kind of emotional issues which constitute the false money wherewith the politicians buy power. They are all forms of the easiest of self-delusions—that of belonging to a chosen race. Step by step the habit of illusion is built up—the old school tie, the club, the regiment, the social class, the nation. In themselves these loyalties are excellent, their dangerous side is that they breed hatreds of the "lesser breeds without the law". The function of an education based on science is to destroy this illusion and to teach people from their earliest formative years that men and women, however diverse as individuals, yet are, collectively and statistically, very much alike. I maintain that this can be effected by a scientific education rather than a purely literary education. The latter is concerned with the past, it pictures the world as governed by the play of emotions, its effect is generally to induce a desire to reproduce the old world and to discourage any confidence in the accelerated tempo science has brought about.

But even education is not enough; men of science will have to organize to make their point of view prevail. This is alien to the temperaments of the leaders in the world of science. They want to remain in their laboratories and secrete knowledge without bothering about its purpose. To do so is to accept slavery.

Association of Special Libraries and Information Bureaux

ANNUAL CONFERENCE AT OXFORD

THE thirteenth Annual Conference of the Association of Special Libraries and Information Bureaux was held at Balliol College, Oxford, on September 18–21. In an address on September 18, Dr. Cyril Norwood, who has succeeded Sir Richard Gregory as president of the Association, dealing with the question of school libraries, asserted that no one can be regarded as educated who has not learnt how to use a library, and directed attention to the difference between text-book knowledge and that which comes from first-hand reading. No man is well educated until he has read real classics and mastered them, has learnt how to consult authorities and collate and use the results.

This point of view formed the keynote of a discussion on the following morning, which was opened by a symposium of papers on "Library Instruction for University and Research Students in America", presented by Miss Granville Meixell, librarian of the Applied Science Library, Columbia University. The first of these papers was by Dr. Peyton Hurt of the University of California, on "Teaching the Use of Libraries", and emphasized the necessity of giving students at least one course in library methods and general bibliography to provide them with a unified outline of the materials and methods involved in using a library for information on a wide variety of miscellaneous substances on which information might be needed during their lives. Dr. Hurt gave a brief account of the course which has been developed at the University of California, and in a subsequent paper Miss E. M. Witmer, Miss E. M. Feagley and Prof. C. Alexander described the consultation services for teachers and for others which have been organized at Teachers College, Columbia University. A special service for doctoral candidates, for example, includes systematic instruction on the location of educational information and data, methods of educational research, and bibliographic research for special areas in education. A further paper by Mr. Louis Shares, of the George Peabody College for Teachers, outlined a programme of library instruction for teachers which provides instruction in the use of libraries and is supplemented by a course of more detailed training for those becoming full-time school librarians, college librarians, etc. The final paper in the symposium, by Mr. Donald Gilchrist, described the instruction in the use of books which is given at St Stephen's College, Columbia.

The symposium stimulated a vigorous discussion which indicated a fairly strong general opinion that systematic instruction in the use of libraries is badly needed in most of the universities of Great Britain, and that many of the municipal and other libraries take very seriously the task of educating the user in the consultation of books and other sources of information.

At a subsequent session, Mr. J. J. Eaton presented a paper on behalf of Mr. W. H. Johnston of the *Yorkshire Post*, describing the methods by which information is collected for the commercial pages of a great daily newspaper. Colonel L. Newcombe, of the National Central Library, described the compilation of a Union Catalogue by the London Public Libraries Union Catalogue Committee. Although expensive to compile, its value in enabling the staff of the National Central Library and the Regional Bureaux to locate books has fully justified the expense, and without it efficient and economical co-operation is impossible. None of the alternatives provides a satisfactory substitute and most of them are also expensive.

The paper presented by Prof. A. M. Carr-Saunders on the "Need for Centralization of Information on Economic and Social Surveys" provoked a lively discussion. Prof. Carr-Saunders dealt mainly with the local social survey, particularly of the type represented by Booth's "Life and Labour of London", repeated by the work of Rowntree and Bowley and the surveys on the Tyneside, Merseyside and elsewhere. Discussing the conditions under which social surveys might be of value to-day, he urged the need for some central authority to guide and co-ordinate local surveys. Research is not everywhere equally worth while, and the areas where surveys are particularly wanted are those with very definite special problems and those typical of a certain kind of area which has not already been surveyed. In the absence of central guidance, there is no certainty that surveys will be initiated where they are most wanted, as the resources are more likely to be found where social problems are least pressing and surveys least necessary.

In addition, Prof. Carr-Saunders is of opinion that central guidance is required to indicate the main objectives which it is now worth while to pursue and also to accumulate and disseminate information as to the best methods to pursue. As an example of objectives for future surveys, he suggested that it would be of value to re-survey some of the places already examined, so as to obtain an adequate measure of changes in poverty. The functioning of the social services also merits attention, and an investigation of local government and the administration of the social services and of their impact upon the population should yield very valuable results. This suggestion is an example of what Sir Josiah Stamp urged in his presidential address to the British Association, and like Sir Josiah, Prof. Carr-Saunders also urged a more equitable distribution of resources between research in the social sciences and the natural sciences. The former is essentially as costly as the latter.

Good discussions characterized most of the remaining sessions of the Conference. Dr. J. E. Holmstrom's account of a system of card indexing of abstracts and research data developed for a small special field to provide instantaneous reference led to some debate on the value of the Universal Decimal Classification. Mr. B. M. Headicar's criticism of the price of Government publications in his rather disjointed paper on the collection, classification and utilization of these works drew a prompt reply from Lieut.-Col. N. C. Scorgie, Deputy-Controller of H.M. Stationery Office, who presided over the session and pointed out that at the present time the price of Government publications is in fact being steadily reduced.

At the final session of the Conference, a paper and demonstration on "The Film in Industry: the Development of the Documentary Film and its Growing Use in Research and Advertising" was given by Mr. John Grierson, of the G.P.O. Film Unit.

The report presented to the annual conference of the Association referred to the publication of the *ASLIB Book List* of quarterly recommendations of scientific and technical books, which has proved a successful development. The work of the inquiry bureau has increased and has been facilitated by the removal to larger premises. The working of the panel of expert translators is being reviewed by a sub-committee with a view to reorganization. The accounts for the year ended June 30 show a small excess of income over expenditure, and the number of members is 305. The report once more refers to the way in which activities are being hampered by lack of financial resources.

Educational Topics and Events

THE Physical Society announces that the eighth annual Craftsmanship and Draughtsmanship Competition will be held as usual in conjunction with its annual exhibition of scientific instruments and apparatus in January next. Competitors must be in the regular employ of a firm or institution which will be exhibiting or has exhibited at least once during the past three years, and which has been invited by the organizing committee to enter its employees for the competition.

THE London County Council's prospectus of lectures and classes for teachers, 1936–37, "designed to bring London teachers into touch with the latest developments in educational methods, to give them opportunities of hearing leading authorities in various branches of learning and on current questions of importance", offers a very wide range of choice to those prepared to give some evenings to the pursuit of these admirable aims and (for the scheme is self-supporting) to pay the moderate fees charged. Last year the entries exceeded 15,000. Among the outstanding attractions are: courses on physical and mental development of children by Prof. H. A. Harris, professor of anatomy in the University of Cambridge; on the development of the child's personality by Prof. Charlotte Bühler of the University of Vienna, director of the Parents' Association Institute; on the psychology of adolescence by Prof. Cyril Burt; on "everyday physics" (the atmosphere, lighting of streets, preservation of food, photo-electric cells, acoustics, modern buildings, etc.) by C. R. Darling; on the Decroly system by Mdlle. Amélie Hamaïde of the Ecole Nouvelle, Ixelles, Belgium; on "electricity in the home" by Mr. J. Paley Yorke; recitals by Miss Jean Sterling Mackinlay to demonstrate how to give songs a dramatic and pictorial value; and single lectures by Mr. Frank Dobson on sculpture, Prof. Walter Gropius on modern architecture, Rosita Forbes on "Through Afghanistan to Russian Samarcand", Prof. P. M. S. Blackett on cosmic rays, Dr. F. A. Freeth of Imperial Chemical Industries, Ltd., on modern developments in chemical industry, Prof. J. B. S. Haldane on heredity, and Sir Frank Smith on wireless waves.

Science News a Century Ago

The Entomological Society

AMONG the matters considered by the Entomological Society at a meeting on October 3, 1836, were a notice from H.R.H. the Duke of Sussex, relative to the injury sustained by the pear-tree, arising from the attack of a small subcutaneous larva, evidently one of the Tincidæ; a memoir by W. Sells on the black caterpillar of the *Athalia centifolia*, one of the saw-flies, which during the past season had caused great devastation upon turnips, and a letter from W. Spence containing additional observations upon the natural history and mode of attack adopted by the *Scolytus destructor* upon the elm trees of France; and proving the necessity of an acquaintance with the precise habits of the insect previous to any wholesale felling of the trees, which, although apparently greatly injured, might not contain a single larva; these observations were supported by various facts which have been noticed by Spence and M. Audouin, professor of entomology at the Jardin des Plantes.—(*Athenæum.*)

Buckland's "Bridgewater Treatise" on Geology

IN a letter written on October 4, 1836, to his father, Lyell said they had just called on the Fittons in Portland Place and had had much talk about the presidency of the Geological Society. Fitton, said Lyell, "told us what Gardner the mapseller has since confirmed that Buckland's edition of 5,000 of the 'Bridgewater' is all sold, and 5,000 more printing, each of which editions, Fitton says, will produce the professor £2,000—a piece of news I am truly glad to hear, for what I have read of the book, I think it will do much good in spreading correct notions of the science, and probably popularise it much. Murchison calls it 'Bridge-over-the-water'; and really that part which is to carry us over the abyss of cosmogony is better constructed than I expected, though I should have been sorry to have had to trust myself upon it. Fitton thinks the moral of it to be, that words may mean anything we like, or that science may require a dangerous rule in its general application."

The Steam Department of the Royal Navy

IN the Public Record Office is preserved an interesting report on the organization of the Steam Department of the Royal Navy, dated October 8, 1836, and signed by Captain Robert Oliver, Lieutenant Thomas Baldock and Master Charles Brown. The name of a steam vessel had first appeared in the official Navy List in 1827, and by 1836 some twenty-six steam vessels were included in the list of H.M. ships. The most important steam vessels were then the *Dee*, *Phoenix*, *Salamander*, *Rhadamanthus* and *Medea*, vessels of about 800 tons and 220 nominal horse power, and it was through experience gained with them that the Admiralty laid down in 1836 the first steam frigates, *Gorgon* and *Cyclops*.

At that time there was no properly organized engineering branch of the Navy, engineers possessed no rank and the manning of the engine-rooms and the working of the machinery gave rise to many questions. The three officers mentioned were therefore appointed to report on the machinery of the steam vessels. Of the three, Captain Robert Oliver had commanded the *Dee* during the blockade of the Dutch coast, while

Lieutenant Baldock had commanded the steamer *Firebrand*, one of the vessels used by the Admiralty for carrying the mails between Falmouth and Malta. To Baldock we also owe a memoir of Her Majesty's Steam Ship the *Medea* during a service of nearly four years.

The London Meteorological Society

WRITING on October 9, 1836, from Wycombe to the editor of the *Analyst* (5, 289), J. G. Tatem directed attention to the value of the study of meteorology, and in the course of his letter said: "It must have been matter for surprise that, while there is scarcely a science or art but receives encouragement and support from a society composed of persons professing the one or attracted to the other, Meteorology does not enjoy that patronage. True it is that, in 1823, a society was established in the metropolis under the denomination of 'the London Meteorological Society', admitting persons residing in the country as corresponding members. Of that society Dr. Birkbeck was the president, Dr. Clutterbuck the treasurer and Mr. Wilford the secretary, with a council consisting of eight members; but it never came into active operation, and soon fell into decay. . . ." It was the aim of Mr. Tatem and others to resuscitate the society so that "Meteorology would be able to boast of having a society as extended and active as any of those which are advancing science in every direction, and conferring so much honour upon the country".

Societies and Academies

Paris

Academy of Sciences, August 24 (*C.R.*, 203, 445–472).

PIERRE AUGUSTIN DANGEARD: Necrological notice on Camille Sauvageau.

GEORGES PERRIER: The Martinique Institut de Physique du Globe.

MIÉCISLAS BIERNACKI: The multivalent functions of p order.

PAUL BOURGEOIS and JACQUES F. COX: The origin of comets. The theory of the galactic origin of cometary matter is in accord with known data.

JEAN DUFAY and HENRI GROUILLER: The proportion of polarized light in the solar corona. After correcting for the width of the slit of the spectrograph and the analysing slit of the microphotometer, it was found that the proportion of polarized light was practically independent of the wave-length in the whole of the spectral region studied. The proportion of polarized light reaches a maximum of 0·26 about 10′ from the edge and this maximum is very flat. This result, obtained for the total eclipse of August 31, 1932, was confirmed by J. J. Johnson during the eclipse of February 14, 1934.

JEAN CHAZY: The approximate calculation of the precession of the equinoxes.

JEAN MARIANI: The law of gravitation and parallel displacement.

RENÉ LUCAS: Absorption of elastic waves in fluids.

NY TSI-ZE and FANG SUN-HUNG: The circular transversal vibration of a hollow quartz cylinder.

EDOUARD ROCH: A zone of irregularities, principally with nuclei of eruptive rocks, in the Haut-Atlas, to the east of Marrakech.

PAUL BERTRAND and PAUL CORSIN: The relative independence of the large groups of vascular plants.

HENRI HÉRISSEY and GABRIEL POIROT: The extraction of a crystallized principle, viburnitol, from the leaves of *Viburnum Tinus*. The fresh leaves give a yield of 0·1 per cent of the substance. Its composition is $C_6H_{12}O_5$; it contains no methoxy group and appears to be a polycyclic alcohol.

JACQUES BENOIT: Hypertrophy of the liver in the thyroidectomized duck. The role of the prehypophysis in its enrichment in lipids.

LÉON VELLUZ: The neutralizing action, *in vitro*, of carbon disulphide on the tetanus toxin.

August 31 (*C.R.*, 203, 473–504).

LOUIS DE BROGLIE: The theory of the photon and the relativist wave mechanics of the systems.

LUCIEN CAYEUX: The microplankton of the Tunis and east Algerian phosphates.

VITO VOLTERRA: Vital least action.

JACQUES DE LAPPARENT: Relation of the bodies of the sepiolite-attapulgite series with the phyllitous silicates of the mica type.

JEAN CABANNES and HUBERT GARRIGUE: A photoluminescence phenomenon in the upper atmosphere: stimulation by solar light of the oxygen line 6300 A.

N. A. SLIOSKINE: The theory of the plane movement of a viscous liquid.

JACQUES VALENSI: Aeroplane wings: the influence of the form of the end of the wing on the marginal phenomena.

ROBERT LACAU: The liberation of a yellow oil in mixtures of tar and bitumen.

G. ZBYSZEWSKI: The extension of pre-Devonian strata to the middle of the eruptive series of Beja (Portugal).

RAYMOND FURON: First results of a geological exploration of the great Iranian desert.

MAURICE ROSE and HENRI BERRIER: The topographical distribution of substances functioning as plant auxins in the young tadpole of *Discoglossus pictus*.

LÉON VELLUZ: The neutralizing action, *in vitro*, of the senevols on the tetanus toxin.

GEORGES BOURGUIGNON and MLLE. RENÉE DÉJEAN: The variations of vestibular chronaxy in hemiplegia with or without aphasia.

CHARLES FLANDIN, PIERRE BARANGER and JEAN RAGU: An attempt at the treatment of leprosy with a new complex compound of chaulmoogra and cholesterol, allowing the intravenous injection of large doses of chaulmoogric derivatives. Description of favourable results obtained by this treatment in twelve cases.

Cape Town

Royal Society of South Africa, June 17.

E. NEWBERY: Mercurous perchlorate and the monovalent mercurous ion.

C. VAN RIET LOWE: Rock engravings in the Vaal River basin. A description of rock-engravings recently discovered in the Vaal River basin, giving their relative chronology, and associating certain early phases with implements of the Smithfield *A* and *B* series.

L. N. COHEN: Studies in the inorganic metabolism of the Kelsey and Gaviota plums (1). Potassium.

Rome

Royal National Academy of the Lincei (*Atti*, 23, 253–276; 1936).

U. CISOTTI: Ballast effects due to a doublet.

G. SCORZA-DRAGONI: Doubly periodic planar translations of Brouwer.

A. GHIZETTI: Determination of the limiting curves of a continuous ∞^1 system of homographic plane curves.

G. BERNARDINI and O. BOCCIARELLI: Valve instrument for registering coincidences between multiplying counters.

G. DAL PIAZ: Geological structure of the Austrides (2). The Austrian alpine system south of the tectonic window of the High Taurus.

V. PUNTONI: Relations between the anærobic actinomycetes of the Wolff-Israel type and *Bacterium bifidum*.

Washington, D.C.

National Academy of Sciences (*Proc.*, 22, 435–462, July 15).

AUREL WINTNER: On the periodic analytic continuations of the circular orbits in the restricted problem of three bodies.

A. E. MIRSKY and LINUS PAULING: On the structure of native, denatured and coagulated proteins. Discussing proteins from the point of view of their physical and chemical behaviour, it is concluded that the molecule consists of one polypeptide chain (sometimes two or more) which continues throughout the molecule. The chain is folded in a uniquely defined configuration, in which it is held by certain side-chain hydrogen bonds. This configuration is the origin of the specific properties of a native protein. Increase in temperature and also certain substances break these side-chain hydrogen bonds, leaving the molecule free to assume new configurations, a process known as denaturation; the denatured protein is thus characterized by absence of a uniquely defined configuration. Dehydration consists primarily in coagulation of molecules without loss of their configuration.

A. H. STURTEVANT and TH. DOBZHANSKY: Inversions in the third chromosome of wild races of *Drosophila pseudo-obscura*, and their use in the study of the history of the species. Fourteen sequences of inversions have been found; most geographical regions show several sequences, but no single sequence occurs throughout the whole range of the species. Study of the sequences should give a clue to their historical relationships.

CURT STERN and VIOLET RENTSCHLER: The effect of temperature on the frequency of somatic crossing-over in *Drosophila melanogaster*. The number of mosaic spots is used as a measure of the *somatic* crossing-over. The frequency of crossing-over is not significantly different at 17° and 25°, but is lower at 30° C.

L. H. KLEINHOLZ: Studies in reptilian colour changes. (1) A preliminary report. General darkening of the Florida chameleon (*Anolis carolinensis*) in the dark and on a dark illuminated background is due to a secretion from the pituitary. Certain regions are darkened by adrenalin or a similar substance.

F. ZWICKY: An expansion-luminosity relation for novæ. A theoretical discussion of a simplified model of a nova.

Forthcoming Events

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

Tuesday, October 6

BRITISH ASSOCIATION OF REFRIGERATION (at the Royal Society), at 6.30.—Dr. Ezer Griffiths: Presidential Address.

Wednesday, October 7

PHARMACEUTICAL SOCIETY, at 3.—Dr. F. L. Pyman, F.R.S.: Inaugural Sessional Address.

Friday, October 9

ASSOCIATION OF APPLIED BIOLOGISTS (in the Botany and Metallurgical Lecture Theatres, Imperial College of Science, South Kensington, London, S.W.7), at 11.45.—Discussion on "The Problems raised by the Woolly Aphis of the Apple—A Case for Team Research"*.

Official Publications Received

Great Britain and Ireland

Sir John Cass Technical Institute. Calendar, Session 1936–1937. Pp. 138+3 plates. (London: Cass Technical Institute.) [49

Edinburgh and East of Scotland College of Agriculture. Calendar for 1936–1937. Pp. 93. (Edinburgh: Edinburgh and East of Scotland College of Agriculture.) [59

Battersea Polytechnic, Battersea Park Road, London, S.W.11. Technical College for Day Students: Calendar for the Session 1936–1937. Pp. 45. 3*d*. Domestic Science Department and Training College: Calendar for the Session 1936–1937. Pp. 32. 3*d*. Department of Hygiene and Public Health: Calendar for the Session 1936–1937. Pp. 18. 3*d*. Evening and Afternoon Courses and Classes: Calendar for the Session 1936–1937. Pp. 29. (London: Battersea Polytechnic.) [59

Other Countries

Bulletin of the American Museum of Natural History. Vol. 72, Art. 1: Further Notes on the Gigantic Extinct Rhinoceros, *Baluchitherium*, from the Oligocene of Mongolia. By Walter Granger and William K. Gregory. Pp. 73+4 plates. Vol. 72, Art. 2: Some Features of the Cranial Morphology of the Tapinocephalid Deinocephalians. By Lieuwe D. Boonstra. Pp. 75–98+plates 5–8. Vol. 72, Art. 3: The Cranial Morphology of some Titanosuchid Deinocephalians. By Lieuwe D. Boonstra. Pp. 99–116+plates 9–17. (New York: American Museum of Natural History.) [19

Proceedings of the California Academy of Sciences, Fourth Series. Vol. 21, No. 29: The Templeton Crocker Expedition of the California Academy of Sciences, 1932—New and Noteworthy Fishes. By H. Walton Clark. Pp. 383–396. Vol. 23, No. 4: A New Central American Snake. By Joseph R. Slevin. Pp. 79–81. Vol. 23, No. 5: The Cranium of the Miocene Gannet *Moris vagabundis* Wetmore. By Lawrence V. Compton. Pp. 83–84. Vol. 23, No. 6: A New Member of the Blenny Family. By Alvin Seale. Pp. 85–86. (San Francisco, Calif.: California Academy of Sciences.) [19

Malta. Annual Report on the Working of the Museum Department during 1935–36. Pp. 35. (Malta: Government Printing Office.) [29

Consiglio Nazionale delle Ricerche: Ricerche sulle Variazioni delle Spiagge Italiane (Istituto di Geografia generale della R. Università di Pisa). Ricerche sul regime dei litorali nel Mediterraneo. Per Agatino d'Arrigo. Pp. viii+172+8 plates. (Roma: Stabilimento Tipografico "Aternum".) [39

Indian Forest Records (New Series). Vol. 1, No. 1: A Preliminary Survey of the Forest Types of India and Burma. By H. G. Champion. Pp. x+286+viii+40 plates. 10.2 rupees; 17*s*. 6*d*. Vol. 2, No. 2: Immature Stages of Indian Coleoptera. (19) Anthribidæ. By J. C. M. Gardner. Pp. 99–113+2 plates. 10 annas; 1*s*. Vol. 2, No. 3: Entomological Investigations on the Spike Disease of Sandal. (28) Cicadidæ (Homopt.). By N. C. Chatterjee. Pp. ii+115–124. 5 annas; 6*d*. (Delhi: Manager of Publications.) [79

Memoirs of the Geological Survey of India. Vol. 70, Part 1: An Attempt at the Correlation of the Ancient Schistose Formations of Peninsular India. By Sir Lewis Leigh Fermor. Pp. v+51+1 plate. (Calcutta: Geological Survey of India.) 1.4 rupees; 2*s*. [79

The Imperial Council of Agricultural Research. Miscellaneous Bulletin No. 9: Statistical Methods and their Application to Agronomy; a Bibliography. Compiled by K. K. Guha Roy, with Additions by P. C. Mahalanobis. Pp. iv+120. (Delhi: Manager of Publications.) 2.2 rupees; 4*s*. [79

Rzeczpospolita Polska: Państwowy Instytut Meteorologiczny (Institut National Météorologique de Pologne.) Wyniki Spostrzeżeń Polskiej Wyprawy Roku Polarnego 1932–33 na Wyspie Niedzwiedziej (Résultats des observations de l'Expédition polonaise de l'année polaire 1932–33 à l'Ile des Ours). By Jean Lugeon, Czesław Centkiewicz, Władysław Lysakowski. Zeszyt (Fasc.) 1: Meteorologja (Météorologie). Pp. vii+88+5 plates. Zeszyt (Fasc.) 2: Magnetyzm Ziemski (Magnétisme terrestre). Pp. ii+73+33 plates. Zeszyt (Fasc.) 3: Trzaski Atmosferyczne (Parasites atmosphériques). Pp. 18+21 plates. Zeszyt (Fasc.) 4: Zorza polarna (Aurores polaires). Pp. xii+21+15 plates. (Warszawa: Państwowego Instytutu Meteorologicznego.) [79