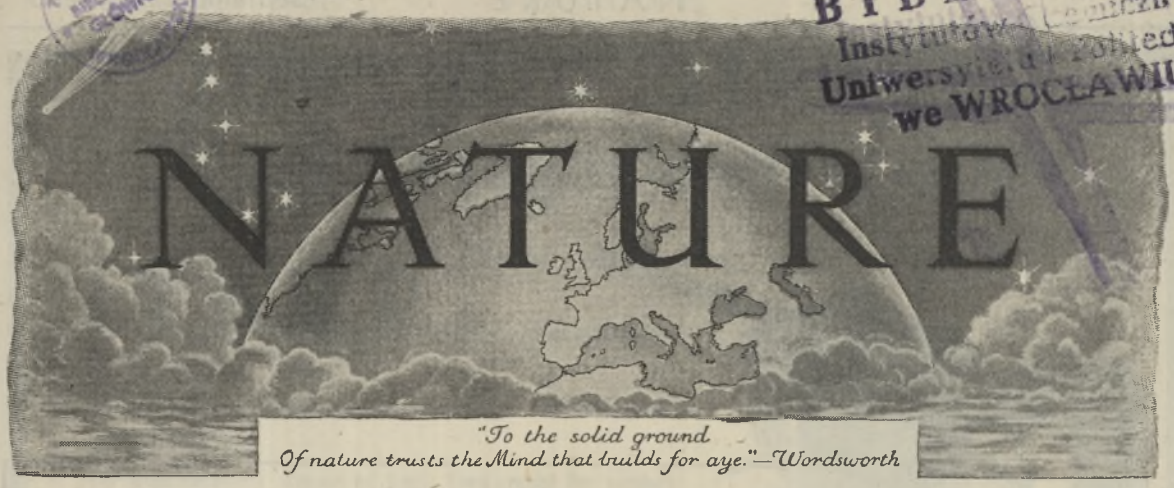

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COLONIAL UNIVERSITIES AND THEIR FUNCTIONS*

IN announcing in the House of Commons on July 13, 1943, the appointment of two commissions to report on higher education in the British Colonies, the Secretary of State for the Colonies, Col. Oliver Stanley, said that he regarded educational advance and economic development as the twin pillars upon which any sound scheme of political responsibility must be based. If the goal of Colonial self-government was to be achieved, Colonial universities and colleges would have to play an immense part in that development. They would, first of all, have to meet the enormously increased need for trained professional workers which growing social and economic services would necessitate, providing the agriculturists, the engineers, the medical men, the teachers, the veterinary surgeons, and the specialists and technicians which the approach to higher standards of life entailed. They would be required to carry out an immense amount of research, and, finally, they would have a great extra-mural task of stimulating general progress throughout the areas of which they were centres, and encouraging the production of teachers from those who gain their knowledge and experience from their daily life.

The four reports which have now come from these two Commissions—for the report of Mr. Justice Asquith's Commission is supplemented by a report from the West Indies Committee of that Commission appointed with Sir James Irvine as chairman in January 1944 "to review existing facilities for higher education in the British Colonies in the Caribbean and to make recommendations regarding future university development for those colonies", while that of the Commission on Higher Education in West Africa, reporting under like terms of reference for that area, comprises both a majority report signed by the chairman, the Right Hon. Walter Elliot, and eight of the members, and a minority report signed by Dr. H. J. Channon, Sir Geoffrey Evans, Dr. Julian Huxley, Mr. A. Creech Jones and Dr. Margaret Read—are notable additions to the literature on the idea and purpose of a university. Considering, in accordance with the terms of reference of the Asquith Commission, the principles which should guide the promotion of higher education, learning and research and the development of universities in the Colonies, and exploring the means whereby universities and other appropriate bodies in Great Britain may co-operate with institutions of higher education in the Colonies to give effect to such principles, the Commissions have produced a series of reports in which the functions of a university, the relation between teaching and research, between academic and extra-mural activities are defined with a lucidity and a certainty that make these reports almost as pertinent to discussions on university

* Report of the Commission on Higher Education in the Colonies. (Cmd. 6647.) Pp. 119. (London : H.M. Stationery Office, 1945.) 2*s*. net.

Report of the West Indies Committee of the Commission on Higher Education in the Colonies. (Cmd. 6654.) Pp. 81. (London : H.M. Stationery Office, 1945.) 1*s*. 3*d*. net.

Report of the Commission on Higher Education in West Africa. (Cmd. 6655.) Pp. 190. (London : H.M. Stationery Office, 1945.) 3*s*. net.

development in Britain as in the Colonies. No better statement on the place of research could be desired than that to be found in the report of the Asquith Commission, and, quantitatively as well as qualitatively, the reports emphasize the close dependence of Colonial development and expansion in this field on the university expansion already contemplated in Great Britain.

Naturally, there is much common ground in these reports, and if the principles are dealt with rather more fully in that from the Asquith Commission, it should not be assumed that the same principles are not adequately emphasized in the others. Pointing out first that the four Colonial universities now in existence—the Royal University of Malta, the Hebrew University of Jerusalem, the University of Hong-Kong and the University of Ceylon—serve only a small proportion of those who live in the Colonies, the Asquith Commission bases the case for the establishment of universities in fresh areas on much the same argument as that used by Colonel Oliver Stanley. In the stage preparatory to self-government, universities have an indispensable part to play. To them we must look for the men and women with the standards of public service and capacity for leadership which self-rule requires. It is the university which should offer the best means of counteracting the influence of racial differences and sectional rivalries which impede the formation of political institutions on a national basis. Moreover, universities serve the double purpose of refining and maintaining all that is best in local traditions and cultures; and at the same time they provide a means whereby those brought up under the influence of these traditions and cultures may enter on a footing of equality into the world-community of intellect.

There is, in the Commission's view, no fundamental antithesis between liberal and vocational education, although the distinction has not yet been fully transcended in the universities of Britain. A university is in a far better position than a specialized institution to provide the courses, both in arts and science, which are the necessary preliminary to professional studies; and, while admitting that the promotion of popular instruction is most urgent, the Commission holds that the development of university education is the more imperative on that account, and as the first step urges the immediate setting up of university colleges. Such colleges would later, in accordance with the advice of an inter-university council, develop into universities serving appropriate areas.

The appropriateness of the area to be served by a university should be determined, according to the Asquith Commission, neither by size nor by population, but by the capacity to supply an adequate flow of students able to profit from higher education; and in accordance with this principle the Asquith Commission and the Irvine West Indies Committee specifically recommend the establishment of a University of the West Indies located in Jamaica. The Commission also supports the recommendation for the establishment of a university in Malaya, the proposal to develop Makerere College in East Africa to full university status, and the scheme for the development of Gordon Memorial College, Khartoum. The recommendation of the minority report of the West Africa Commission for the development of a single institution of university rank to serve the whole of British West Africa, entitled the West African University College and located at Ibadan in Nigeria, with a territorial college in each of the three main dependencies, appears to be more in keeping with this principle than that of the majority for the development of three university colleges at Ibadan, at Achimota in the Gold Coast, and at Fourah Bay in Sierra Leone.

Discussing next the range of studies, the Asquith Commission insists in the first place on the importance of a balance between professional and other studies, and accordingly the universities should include teaching in a fairly wide range of subjects. Every student, urges the Commission, should be given an opportunity to become aware of certain great conceptions. He should know something of the place of science in modern civilization and the use of scientific method; he should have learnt something of what is meant by sociology, so that he is aware of the other elements and forms of civilization. He should be enabled to gain some apprehension of what is involved in philosophy in its widest meaning, and some sense of the past as expressed in great literature and in the record of history. If his time at the university does not open his eyes to the existence of those great forces in modern life, the student, however expert in his own work, will have missed one of the great advantages which the university can offer him; here one may well wonder what proportion of students at British universities have really seized the opportunities to which the Asquith Commission points.

This vital principle appears largely to have been overlooked by the majority of the Elliot Commission, though both Commissions recognize the importance of a sound principle: the universities should be residential. Similarly, there is adequate recognition of the importance of providing fully equipped libraries and laboratories, and buildings such as union premises and halls of residence; and questions relating to staff and their environment and conditions of service are discussed with full understanding of the personal issues involved. In particular, the importance of adequate contact with academic life in Great Britain and elsewhere is emphasized and, like the Colonial Research Committee, the Commission fully appreciates the necessity of mitigating the isolation of the teacher or investigator in Colonial universities and colleges. As is pointed out, the whole future of the proposed new universities may depend upon the intellectual standards, wisdom and experience in academic administration of those who mould a college into a university, and carry the university through its first years. At the best, it will not be easy to obtain sufficient men and women of the right quality; and the importance of conditions of leave, of superannuation and secondment as factors in attracting and retaining academic staff of the desired quality is not easily overstressed.

It is clearly to the advantage of the new universities and university colleges proposed in these reports that the fullest contact should be established between them and other centres of research in the territories they will serve. Such contacts will do much, as the Colonial Research Committee has already noted, to counteract the isolation in which research must often be carried on in the Colonies; but the Asquith Commission has rendered a notable service to the establishment of right relations by the clear and emphatic way in which it defines the place of research in the Colonial universities, the field open for such research, and their relations with institutes of applied science. Equally lucid is the chapter in which the Commission develops its argument for an Inter-University Council for Higher Education in the Colonies; that chapter alone leaves no room for doubt as to the help which the universities of Great Britain can render in the developments proposed, and the value of such developments in forging the permanent intellectual links which are so desirable in the world to-day in the interests of peaceful progress.

The Inter-University Council recommended by the Asquith Commission would be a co-operative organization of the universities of Great Britain and the Colonies, charged in general terms with the two distinct tasks of co-operating with existing Colonial universities and of fostering the development of Colonial colleges in their advance to university status. The Commission has not overlooked the work being done in a more general field by the Universities Bureau of the British Empire, but considers a new body would be more appropriate for the discharge of its special function in connexion with the staffing of Colonial university institutions. Here the proposed Council, which would probably carry out much of its work through an executive committee, and would be provided with a permanent secretariat, including a full-time secretary of distinction and experience, and adequate office accommodation, should render considerable service. Other functions of the Council, in addition to acquainting itself with the present position and need of the Colonial universities, would be to facilitate arrangements for such institutions to receive visitors annually, to advise them on any matter of academic policy or research on which they sought its help, to assist the placing of Colonial students in universities in Britain, and to encourage Colonial studies in the home universities and thus stimulate both valuable contributions to the literature on Colonial problems, and an increasing interest in Colonial affairs among their students. The Council would also be available for fostering co-operation with the Dominions or India. But the Commission does not recommend that it should be asked to advise on the allocation to Colonial universities and colleges of grants from United Kingdom funds; for that function an entirely new body, which might be known as the Colonial University Grants Advisory Committee, should be created.

The Commission considers that it is essential that Colonial universities should be autonomous in the sense in which the universities of Great Britain are autonomous; although publication of an annual report, accompanied by a financial statement, and periodical visitation by a properly constituted authority are regarded as reasonable. A constitution is sketched for Colonial universities which offers the autonomy which secures the degree of freedom of teaching and research fundamental to a university, and the Commission examines with some care the period of transition from college to full university status before recommending that for the initial period students should enter for the London external degrees in continuance of the practice followed hitherto in several of the Colonial colleges. Degree-giving powers should be conferred on the Colonial institutions in due course; and the following qualifications are suggested: the staffs must have had adequate experience of work of a university standard; their conditions of work have permitted the active prosecution of research or original work; and a substantial number of students have completed satisfactorily the courses for degrees in a sufficient variety of academic subjects.

Finally, in this first part of its report, the Asquith Commission discusses the thorny problem of entrance qualifications, recommending the passing of a special college entrance examination; the provision of scholarships and financial assistance; the position of Colonial students in Great Britain, on which it recommends the extension of facilities for post-graduate studies, but the limitation of undergraduate study, as the colleges develop, mainly to those students taking exceptional subjects for which there is no local provision; and finance. As regards the last matter, it is considered that the establishment of a university in the West Indies will involve capital expenditure of about £1,130,000 and recurrent annual expenditure of £139,690; some additional funds will also be required by the Imperial College of Tropical Agriculture at Trinidad. Considerable additional funds will be needed by Makerere College in East Africa, and financial assistance in varying degrees may be required in Palestine, by the Royal University of Malta, and in Malaya and Hong Kong. The majority proposals of the Elliot Commission involve capital expenditure of about £1,500,000 and recurrent annual expenditure of about £250,000. The minority report, without entering into detail regarding the financial aspects of its proposals, does not suggest that the capital expenditure involved is likely to be less, but that the elimination of the multiplication of university facilities will result in a somewhat smaller annual expenditure.

Both Commissions recommend that part of the funds available under the Colonial Development and Welfare Act should be specifically assigned to the establishment of universities in the Colonies, and refer to the importance of a stable annual income for orderly development. The Elliot Commission contemplates that ultimately the West African Governments will bear the whole annual cost, and the Asquith Commission points to the desirability of the Colonial institutions building up endowment funds.

(*To be continued.*)

SOME CAMBRIDGE MEN

Alumni Cantabrigienses

A Biographical List of all known Students, Graduates and Holders of Office at the University of Cambridge from the Earliest Times to 1900. Compiled by Dr. J. A. Venn. Part 2: From 1752 to 1900. Vol. 2: Chalmers—Fytche. Pp. iv+ 594. (Cambridge: At the University Press, 1944.) £7 10*s*. 0*d*. net.

GLANCING through this volume, one gains the impression that the great majority of Cambridge graduates in the late eighteenth and the nineteenth centuries went into the church or into the professions of law and medicine; a smaller number became schoolmasters, entered the army or took up government service at home or abroad. The link between the clerical profession and an active scientific career was closer then than it is now, and it is not without interest that Charles Darwin, the outstanding figure in this volume, went to Cambridge to get a degree as a necessary preliminary to a career in the church. The Darwin family, with William, George, Francis and Horace, provides the best example of the inheritance of scientific power.

One of the most striking groups to be noted is that of the explorers. Doughty of *Arabia Deserta* may be coupled with Drake, the companion of Palmer and Burton. Cheadle with Viscount Milton was an early explorer of western Canada, while Clifton travelled with the Eskimos to the hunting-ground of the musk ox. The latter also broke new ground in Africa, as did Cotterill at Lake Chiassi and Crichton-Browne in Morocco. De Windt in his adventurous travels as a newspaper correspondent gained intimate knowledge of the insides of Siberian prisons. Polar explorers include Ferrar, geologist with Scott, and Fisher, astronomer to Parry on his expedition to find the north-west passage. Of Viscount Melville it is stated that he greatly encouraged Arctic explorations.

Martin Conway and E. A. Fitzgerald provide a link between explorers and climbers. Among the latter we find Cust, who made the first guideless ascent of the Matterhorn, Julius Elliott, also John Ellis, who was in the first ascent of the Finsteraarhorn. Other branches of sport are represented by R. F. and H. L. Doherty, Steve Fairbairn and Henry Foster, father of the seven Fosters of Oxford and Worcestershire. Admiral Fawkes was in a service not frequently claiming Cambridge men until the days of the 'Cambridge Navy' after the War of 1914–18. The Army is much more generally supported, especially through those who fought in that War. William Edwards of Trinity won the V.C. in 1883.

Coleridge, Edward Fitzgerald, Lowes Dickinson and Crabbe stand for literature in this volume. Politicians are numerous: Austen Chamberlain, Harold Cox, with his uncontrollable conscience, Clarkson the abolitionist, and Thomas Creevey of the "Creevey Papers" illustrate a wide diversity of types. Lorimer Fison, student of the Australian aborigines, turns the mind to James Frazer of the "Golden Bough".

The names of professional men of science occur in great numbers: we find two Astronomers Royal in Christie and Dyson, while Fallows was only prevented by an untimely death from being the first H.M. Astronomer at the Cape of Good Hope. The Royal Institution is represented by Humphry Davy, James Dewar and Michael Foster. Of mathematicians we may name Chrystal, Forsyth, W. K. Clifford and Augustus de Morgan. Entomologists include Baron Walsingham, who studied the smallest of moths, and Eltringham. Fitton worthily represents geology, W. R. Fisher Indian forestry, and W. H. Cole the Indian survey. John Elliott organized meteorology in India, other geophysicists being Dines the meteorologist, and Davison the seismologist. William Fairbairn, Dalby and Ewing were notable engineers, the two latter doing valuable work for the Admiralty in the War of 1914–18. Froude, the naval architect, has his name linked with the Froude tank at the National Physical Laboratory. Medicine has many names. Here we mention Walter Fletcher, organizer of the Medical Research Council, and Elliotson, who first used the stethoscope. The latter was of independent mind; he was one of the pioneers in the use of mesmerism, and he was the first to discard the knee breeches and silk stockings worn by his colleagues.

There remain for mention a few who catch the eye by something unusual in their careers. The Rev. W. B. Clarke discovered gold in New South Wales. Dunville was a keen racer in balloons, while Edward D. Clark kept an immense balloon for some days in the hall of Jesus College, finally launching it from the Cloister Court. The thirteenth-century arches in that Court were discovered by Osmond Fisher in 1840 and opened up by him fifty years later. The Hon. Richard Fitzwilliam gave the University the magnificent benefaction of the Fitzwilliam Museum. De Thierry, a French refugee, became an adventurer—"King Charles" of New Zealand. A less reputable adventurer was James Fennell, the actor, "who never paid his bills and passed his life between a palace and a prison".

F. J. M. STRATTON.

ANTIGENS AND ANTIBODIES

The Specificity of Serological Reactions

By Dr. Karl Landsteiner. Revised edition. With a Chapter on Molecular Structure and Intermolecular Forces, by Linus Pauling. Pp. xiv+310. (Cambridge, Mass.: Harvard University Press; London: Oxford University Press, 1945.) 28*s*. net.

THE study of serological reactions has for years attracted many workers. There have been fierce controversies between the exponents of differing theories, and these controversies have stimulated both thought and work. During the last thirty years progress has been very rapid, and continues to be so, although relatively little work has been possible in Great Britain during the war years. The production of a revised edition of this extremely valuable book is therefore most welcome.

The new edition is very greatly expanded and almost completely rewritten because of the rapidity of the advances made during the eight years since the previous one. Further, two new chapters have been added; the one on antigen-antibody reactions and the other, written by Linus Pauling, on "Molecular Structure and Intermolecular Forces". In the former there is a historical survey of the theories of antigen-antibody reactions followed by a discussion of those current to-day. In the latter, Dr. Pauling gives a short, clear account of the relation of intermolecular forces to molecular structure which does, however, necessarily assume a considerable preliminary acquaintance with the subject.

Perhaps the most striking of the advances in immunology which have occurred in the last ten years are those, so much dependent on the development and use of electrophoretic technique, which have been made in the study of antibodies. It is interesting to compare the lack of definite knowledge and the contradictory evidence put forward at the time of the last edition with the accumulation of definite knowledge and the promise of continued advance which are so ably recorded in the corresponding chapter of the 1944 edition. In other parts of the subject no new technique of comparable importance to that of electrophoresis has been developed recently, and although numerous and important advances have been made there are not such great changes in outlook and prospects.

The objects of the book are in no way changed. A clear, concise, connected and authoritative account of this expanding subject has been given in a readable form. The bibliography is extensive; more than 2,000 references are given, and the author is more than justified in saying that he has attempted to offer a bibliography comprehensive enough for the use of workers in the field.

Unfortunately, in this edition, possibly to save paper, a system of abbreviations for journals and text-books is used in which, except in one case, a maximum of three letters is allowed. The reviewer has great difficulty in remembering even those initials which occur most often, especially when they bear so little relation to the full title, as 'Pr' for *Proceedings of the Society for Experimental Biology and Medicine*. This type of abbreviation is coming into wider use; but is certainly difficult for the reader and can only be justified as an emergency measure for saving paper.

Dr. Landsteiner and his colleagues have done a very large amount of very important serological work, much of it on antigens and serological reactions using simple compounds. It is fitting that a new edition of "The Specificity of Serological Reactions", prepared shortly before his death and printed posthumously, should be his last published work.

J. A. R. Miles.

MEASURING THE INFANT'S MIND

Intelligence Tests for Young Children

By Prof. C. W. Valentine. Pp. xii+68. (London: Methuen and Co., Ltd., 1945.) 4*s*. net.

IN this little book, Prof. C. W. Valentine has arranged a series of tests into a scale for assessing the 'intelligence' of children between eighteen months and eight years of age. For backward children the scale is recommended as suitable up to the age of eleven years. Tests are provided at half-yearly intervals up to the age of four, that is, during the period when mental growth is apparently more rapid, and thereafter at yearly intervals. Although the scale is intended chiefly for teachers, it is also meant for the use of that *rara avis*, an 'intelligent parent', eager to weigh the native talent of his offspring.

Apart from four new tests, all the material is borrowed, often with slight modifications, from Burt, Gesell, Stutsman and from the Merrill-Palmer and Terman-Merrill scales. In many cases new age assignments have been given. As in the Binet scale, the tests are scored on a pass-fail principle, and all test items are given equal weight, though no evidence is offered that they deserve it. A practical advantage is the simplicity of the apparatus required.

The reader may be surprised not to find in a book of this kind, where the emphasis is upon intellectual ability, any reference to the work of Dr. Charlotte Bühler, for Dr. Bühler's aim is to judge the degree of maturity attained by the child's personality as a whole, including its cognitive aspects.

A few of the 'tests', for example, bowel and bladder control, are scarcely tests at all in the sense of sampling responses in a standardized situation, for success in them depends on habits acquired under varied conditions of training. Without further evidence, one cannot therefore regard them as indexes of basic ability. The validity of the 'sentence completion' test at age six is also questionable, since it requires the highly specific ability to use two prepositions. One intriguing point is the author's statement (p. 10) that he found a "very close correspondence between very early tests (at only 12 or even 6 months) with tests of intelligence at 10 years and later". One would like to know precisely which tests were given at the age of six months to obtain such good predictions of later ability.

Intelligence testing originated in the practical aim of detecting inferior and superior educable capacity. During the school years the tests can be validated, because an independent criterion of what is measured by the test can be obtained—the teacher's estimates or school marks. In testing pre-school children, however, especially those less than two years of age, no such criteria are available and the question arises: What in fact do the tests measure? Almost certainly it is not just intellectual capacity, as might be the case in later years, but something affected by the child's whole make-up, including sociability, shyness, timidity and the affective dispositions generally. Prof. Valentine is well aware of this. The predictive value of intelligence tests at the early years is low, if only because of the low test reliability at these years; testing young infants is a painstaking task which makes it difficult to obtain consistent results. Although the test stimulus is designed to evoke a cognitive response alone, in reality, the child's entire personality reacts, and this influences the specific response to the test adversely or favourably. It would seem that Prof. Burt's observation made twenty-five years ago is unfortunately still to some extent true: "With infants, indeed, all tests and all estimates are bound to be more or less unsatisfactory" ("Mental and Scholastic Tests", p. 200).

Prof. Valentine admits that the age assignments are not altogether satisfactory, especially in the very early years. Thus the 'action agent' test at age three requires the infant to know the meaning of such words as 'gallops', 'aches', 'explodes', 'roars', etc. This surely deserves a higher age assignment than the Binet test in which the child is required to point to its nose, eyes, mouth, hair and knee, or the one in which the child has to put on his shoes. Some brief experiments by the reviewer confirm this view. Nevertheless, the scale may be warmly recommended for further experimentation and clinical use. It may be justified as a device for roughly gauging the general ability of young children, the estimates improving in accuracy as the child grows older. Much careful work is, however, needed, as the author would doubtless agree, before all the tests could claim a sound theoretical foundation.

John Cohen.

ACHIEVEMENT IN MEDICAL SCIENCE

British Achievement in the Art of Healing

(Achievement Book No. 4.) By John Langdon-Davies. Pp. 36. (London: The Pilot Press, Ltd., 1945.) 2*s*. 6*d*.

THIS publication is one of a series of Achievement Books, the three preceding issues of which record British achievement in art and music, farming and in aircraft. The author of this issue, Mr. Langdon-Davies, pays a richly deserved tribute to modern medical work. "British medical science", he says in his foreword, "is loosely and illogically organized. In spite of this, there can be no doubt that the British medical profession rose to the occasion and solved the problems of war more successfully than they have been solved before in military history. . . ." Some of the problems which faced those others who were charged with medical service at the battle fronts and the means they adopted to meet them are also illustrated in this publication.

Mr. Langdon-Davies has had to contend with the inevitable limitations of space; but his vivid, experienced writing overcomes this difficulty and he is greatly aided by the remarkable photographs of which the publication is largely composed. The very large number of people, medical and non-medical, who contribute essential things to medical work nowadays, is aptly illustrated by the story of what happened to the shattered leg of a soldier in 1915, 1917 and 1940. In 1915 he very often died; in 1917 his life was more often saved, but he remained a cripple for life; in 1940 he was made fit again for duty and he will return to civil life as fit as anybody, even though a limb may have been lost. To this result medical men, scientific men and others all over the world have contributed, and it would be difficult to find a more magnificent example of the co-operation of men of all nations for the common good.

In the succeeding pages Mr. Langdon-Davies takes us through the training of the soldier, describing the improvements in his nutrition and the psychological examinations which improve morale by recognition of the fact that everybody is afraid in battle and by weeding out those whose mental histories predispose them to what used to be called 'shell-shock'. The treatment of shock and of the burns and injuries due to mines which have been so characteristic of this War, the story of blood transfusion and the management of pain and the now well-known histories of the sulphonamide drugs and of penicillin are well told and illustrated by excellent photographs. Plastic surgery, the closed-plaster treatment of injuries, rest and that vital stage in the healing process upon which increasing emphasis is now being laid, namely, rehabilitation, are each briefly described. The subsequent sections on tuberculosis and its detection by mass radiography, on typhus and its control by D.D.T., on malaria and venereal disease introduce us again to civilian life, for these are some of the gravest problems of that war which never ends, the war waged by disease against soldier and civilian alike. The achievement of that 'positive' health which is the subject of the last section is helped by no national mobilization; no Parliament votes fantastic millions to secure it; but to it modern science goes on quietly contributing new weapons which we can use or neglect as we wish. Publications like this should help all those who are trying to remove the suffering and loss caused by disease; for they spread sound knowledge; and knowledge removes the fear, apathy and uninstructed individualism which are among the root causes of so much ill-health and consequent inefficiency and unhappiness all over the world.

G. LAPAGE.

PHARMACOGNOSY

A Textbook of Pharmacognosy

By T. C. Denston. Fourth edition. Pp. xviii+594. (London: Sir Isaac Pitman and Sons, Ltd., 1945.) 27*s*. 6*d*. net.

THIS text-book of pharmacognosy has already found wide recognition among teachers and students of pharmacy. Its subject matter has grown from a laboratory manual intended for use in practical classes, and now comprises the requirements for the Chemist and Druggist Qualifying Examination of the Pharmaceutical Society of Great Britain.

The accounts of the various drugs are systematized and include biological and geographical sources, plant habits, methods adopted in cultivation, collection and preparation for marketing, chief constituents and instructions for practical work. Under the last heading are given schematic descriptions of the drugs and also qualitative chemical tests. The line-drawings are a valuable addition to this section of the work, emphasizing as they do the characters on which recognition is based, and acting as a guide to clear and accurate representation of morphological characters to the student in his own drawing. With the description and the drawings before him, the student can examine a commercial sample of a drug and then proceed to record his own observations.

The organized drugs are classified according to their morphological nature so that they can readily be compared. This is advantageous when points of difference have to be memorized for examination purposes. The drugs of animal origin are grouped together, and the unorganized drugs are arranged according to their similar properties. There is also useful information on drug constituents, stabilization, drying, preservation and adulteration of drugs. The subject matter of this edition has been extended to include the requirements of the addenda to the British Pharmacopœia. Halibut liver oil now receives notice; but the section on the vitamins has been deleted. Mention is made of the effect of war conditions on drug supplies. Additional reproductions of photographs add interest to an already well-illustrated text.

It is unfortunate that considerations of economy have necessitated production on paper of poorer quality than that of previous editions, and that, in spite of this, the price has had to be raised to 27*s*. 6*d*. from 20*s*. These are circumstances over which the author and publishers have no control, and they do not in any way impair the value of the information presented to the reader. The text-book is of convenient size and serves the purpose for which it is intended. It can be confidently recommended to students entering upon the study of pharmacognosy, and particularly to those who are candidates for the chemist and druggist qualification.

W. O. HOWARTH.

A RECENTLY DISCOVERED MANUSCRIPT BY LINNÆUS

By Dr. ANDERS GRAPE
Chief Librarian, University of Uppsala

IT is a well-known fact in medico-historical research that the pharmacopœia, which was published in Stockholm in 1775 under the title of "Pharmacopoea Svecica", and at that time received with much enthusiasm both in Sweden and abroad, was prepared with the co-operation of Linnæus himself. The keen interest which the great botanist displayed in the production of a newer work, that might be substituted for the antiquated "Pharmacopœia Holmiensis", published in 1686, was also proved in many ways. (For the last-mentioned work see S. Lindroth in *Lychnos*, 1943, and E. L. Backman in the *Proceedings of the Uppsala Medical Association*, 1923/24.) That Linnæus already in his youth had his attention directed to this subject is shown by a small manuscript, which, like the bulk of his manuscripts left, belongs to the Linnean Society of London, and which just bears the title "Pharmacopoea Holmensis"; and in the correspondence exchanged for many years with his intimate friend, Dr. Abraham Bäck, president of the Collegium Medicum in Stockholm, the question is raised repeatedly from 1749 onward of a fresh and improved pharmacopœia. "You, my friend, who are the only person at the Collegium Medicum, if anything can be done, should touch up the pharmacopoeia", writes Linnæus on October 23, 1749, and a month later Bäck sent a list of the medicines of animal origin in the older pharmacopœia, from which he wishes to delete more than two thirds. After the College some years later (1753), in conformity with a royal decree, had seriously attacked the task of compiling a new "dispensary book", Linnæus probably followed the development of the scheme with constant interest; this is seen *inter alia* from the academic dissertations ventilated during his presidency; for example, "Plantæ officinales" (1753), "Censura medicamentorum simplicium vegetabilium" (of the same year), and several others.

It must, however, be said for the Medical College that serious difficulties arose which prevented a start being made with the work. A circular letter which had been sent to the medical faculties, physicians and apothecaries of the country had certainly caused all sorts of proposals and suggestions to be sent in, and contributions of varying value. These—the greater part of them preserved in MS. No. 151 at the Caroline Institute's Library (Stockholm)—had in their turn been sent to the members of the College; but when the manuscript proper was to be prepared, it consisted of a series of beginnings. In 1755 the various parts were certainly distributed so that each and every one should deal with a certain section, and it was also from the start agreed that in the first instance the British dispensatories, the Pharmacopœia Londinensis and the Pharmacopœia Edinburgensis, were to serve as prototypes. But as easily and often happens, when it is a question of collective work and divided responsibility, none seemed to take the matter seriously—at any rate nobody but the president, Bäck. His admonitory voice was heard time and again at the College, but his appeals to his colleagues were apparently without effect. After eight years had thus passed without the work having advanced, Bäck, in the year 1761, found it necessary himself to undertake the task of drawing up a proposal, which of course was received with approbation by his colleagues. For Bäck, who was very busy, partly as a medical practitioner, partly in his capacity of physician to the royal family, and was forced to stay for lengthy periods at the royal palaces outside Stockholm (Drottningholm, Ulriksdal), the acceptance spelled a serious amount of labour; and it can be understood that for that reason he was forced to seek assistance from his friend, Linnæus. The latter entertained a keen interest in pharmacology, particularly that part of it concerned with simples (simplicia), that is, materia medica; he had published Part 1 of a work dealing with the vegetable substances, and with a certain regularity there occurred a course of lectures on this subject in his academical teaching at Uppsala. At Bäck's request, he has now clearly undertaken to elaborate this part on Bäck's behalf. This is apparent from his letter to the latter, dated November 17, 1761, in which he begs Bäck insistently to procure a royal mandate for the patent of nobility which King Adolf Frederik had promised him, and for his part, he makes the following promise: "I on my part shall do my best that Materia medica will be to your credit and honour". In December of the same year he had sent to Bäck the promised manuscript; for he relates, in a letter of December 22, that he has sacrificed two nights for fair copying, which had therefore been done somewhat hastily, and that in such circumstances a further examination might be found necessary, etc.

As is easily understood, there has been some curiosity regarding the particular nature of Linnæus' manuscript; but it has been generally assumed that it had not only formed the basis for the section on materia medica as this appeared in the completed pharmacopœia when it was eventually published, but also that it was in every particular identical with this version. But there need no longer be any doubt about this point, since I have succeeded in showing that the original manuscript in question is still preserved in perfect condition, although it has hitherto been overlooked by investigators. It consists of 26 foolscap pages, comparatively well written, and is inserted in the previously mentioned volume No. 151 in the library of the Caroline Institute—perhaps the fact that the manuscript happened to be bound up with the previously noticed papers from the early years 1753–54 has contributed to its real nature being overlooked. In this case, too, it is the vegetable substances that are listed. The botanical kingdom quite as a matter of course occupied the foremost place in the heart of 'Princeps Botanicorum'. It should be added, however, that in another manuscript in the same collection (No. 42), there is a sheet in quarto which, in Linnæus' handwriting, contains a fairly hastily made summary of *Animalia* and *Lapidea*, that is, medicines derived from the animal and the rock kingdoms.

It has been possible for me now to show by a detailed comparison with the final version that Linnæus' contribution was not accepted without any further ado, but has been subjected to quite a thorough treatment, including both deletions and additions; but it is impossible to enter upon this matter here in detail. It is not without interest to have been able to ascertain that the revision was carried out by Anders Jahan Retzius, who, in 1769, assisted Bäck in his work on the pharmacopœia—for it was not until that year that the work was finished on Bäck's part. Retzius was eventually

appointed professor at the University of Lund, where he carried out pioneer work in several branches of natural history and took the initiative in the foundation of the Royal Physiographical Society; he also founded a family which has produced several prominent natural scientists.

Although the manuscript here mentioned can scarcely be counted as particularly remarkable, the discovery must yet from a Swedish point of view be considered as valuable. For Sweden's national treasure of Linnæan manuscripts was, as is generally known, in the year 1784 so greatly reduced through the indifference of the Swedish authorities and the enthusiasm of James Edward Smith, that every addition is welcomed with satisfaction.

KILIMANJARO: CRATER FUMAROLES OF KIBO AND SEISMIC ACTIVITY DURING 1942-45

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IN view of the interest aroused by the activity of Kibo, after several groups of fumaroles had been located in its crater in 1942, it may be useful to give an account on further developments which have taken place on Kibo lately. Full reference to the activity of Kibo's fumaroles in October 1942 and their increased number in February 1943 (see Fig. 2) was made by the writer in a paper on Kibo, past and present, which was sent for publication in July 1943 to the *Journal of the East African Natural History Society*. This paper is as yet unpublished, through printing delays due to the War.

The occasional observations of 1942–43, made in spare time, and the scanty information obtained from the few mountaineers who visited the true crater, were of little value. Only patient observations, requiring time, would permit more precise deductions on events on Kibo. Despite great difficulties attached to regular observations made on a mountain nearly 20,000 ft. high, the indispensable periodical readings of the fumaroles temperatures of Kibo were arranged at the beginning of 1944. I was greatly assisted in this by the honorary secretary of the Mountain Club of East Africa, Mr. J. W. Smethurst of Marangu, who put at my disposal the well-known guide Johane, who accompanied me to Kilimanjaro on several occasions. Johane and an assistant, after having been shown how to take temperatures, ascended Kibo once every month (weather permitting) to record temperatures at five selected spots in the crater. They also checked up the amount of precipitation from four rain-gauges or totalizators installed by me in 1943 on Kilimanjaro, after consultation with Group-Captain A. Walter and suggestions made by Mr. C. Gillman in 1938. These rain-gauges were situated at altitudes of 7,200 ft., 9,400 ft., 12,500 ft. and approximately 16,000 ft. The instrument at 16,000 ft., being unsuited for the collection of snow, was brought down this year at 14,000 ft., on the saddle west of Mawensi, and I took up and installed on March 10, 1945, two snow-gauges at 16,000 ft. and 19,100 ft. for the British East Africa Meteorological Service.

The readings of the temperatures of the five fumaroles mentioned will be extended to nine in future. These five fumaroles were selected, among other reasons, for their positions south, south-east, south and west in different sectors of the crater, rather than for their high temperatures. These regular readings are sufficient to indicate important changes, should these take place. The monthly readings in 1944 give the averages shown in curve *A* of Fig. 3.

The slightly fluctuating curve shows a maximum temperature of 67° C. in February 1944 and a minimum of 47° C. in April 1944, making a difference of 20° C. The variation in temperature between the first and the last month of the readings is 6° C. (lower). When the precipitation figures *B* from the two highest stations—Peters hut, 12,500 ft., and Kibo hut, 16,000 ft.—are examined, it would seem that in the first months, the fumaroles, in other words, the thermic gradient of the volcanic plug of Kibo on the periphery of which (with the exception of fumarole No. 1) the fumaroles are placed, were affected by weather fluctuations. This is most unusual on deep-seated fumaroles as against so-called 'secundary fumaroles' the temperature of which may change very much according to the amount of precipitation. For Kibo, however, this seems disproved by the behaviour of the fumaroles later in the year.

The approximate upper-air temperatures (curve *C*) taken 20,000 ft. above Nairobi on the same dates as the temperatures of the fumaroles are unlikely to have been very much different from those prevalent above Kilimanjaro. They give the same evidence: that the outside influence on the fumarole temperatures is mere coincidence.

The figures obtained from the fumarole temperatures cover too short a period to allow a definite interpretation at this juncture. One has to keep in mind that fluctuations of a still greater order than

Fig. 1. Top of Kibo, caldeira and northern crater in 1943. Photo: E. Robson, Nairobi.

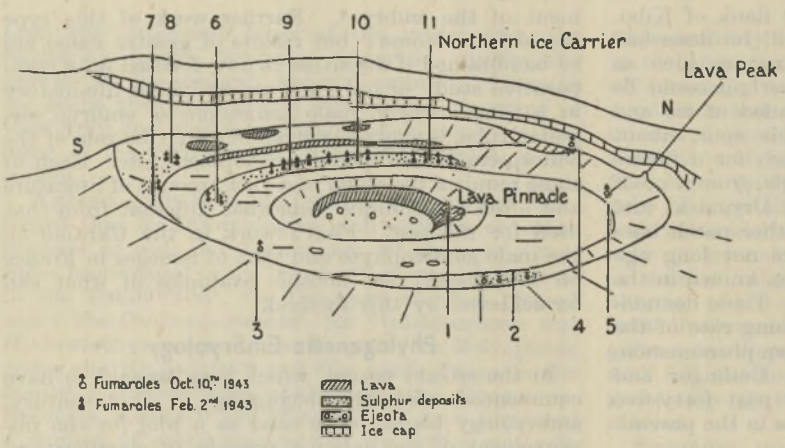

Fig. 2.

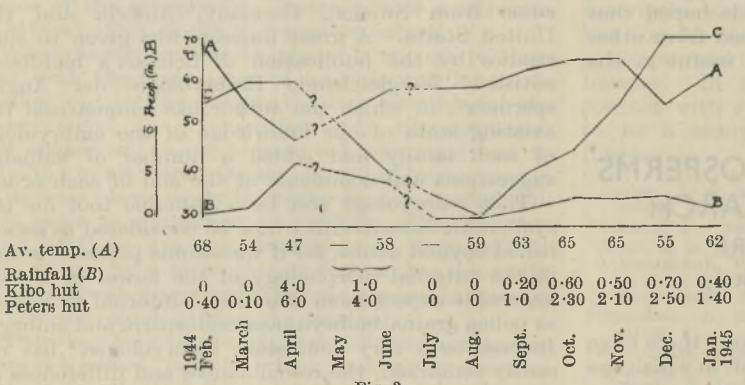

Fig. 3.

those found in 1944 may have occurred before. We know next to nothing of the behaviour of the crater even since the year 1927, when Dr. R. Reusch first entered it, or in 1930, when Mittelholzer flew over Kibo and published the first photographs of the crater. We have only Tillman's evidence of 1933 of "sulphur fumes discharging from the outer rim on the south side". My personal, general impression on March 10, 1945, was that of a diminution of the activity of Kibo crater since 1942. This is corroborated by the temperature readings in 1942 and in 1945. I recapitulate here some facts, for what they are worth, as evidence for the present :

On October 10, 1942, the temperatures of the eastern fumaroles, No. 2 (absent in June) averaging 91° C., were high. On February 2, 1943, the four points of issue of the fumaroles were much less marked and the fumes replaced by a light screen of water vapour involving only a small part of the slope. The average temperature was only 53° C. during 1944, 52° C., on March 10, 1945.

The south-eastern fumarole, No. 3, showed a temperature of only 37° C. in March 1945, compared with 60° C. in February 1942.

While in February 1943 the upper part of the southern slope was alive with fumes from fumarole groups 6, 7 and 8, there was very little vapour to be seen during March 1945. Temperature, February 1944, 90° C. ; March 1945, 71° C.

The western fumaroles Nos. 9–11, when allowing for periodic small fluctuations as mentioned, showed approximately the same temperatures throughout 1944. In March 1945 they were of very similar aspect to that of 1942–43. This is also shown by photographs taken then and now.

Fumaroles 4 and 5 in the northern sector of the crater were in existence in October 1942 and February 1943. Their temperature was not measured, but in 1945 they do not appear to have changed from their behaviour of two years ago.

Spink's paper in the *Geographical Journal* of May 1944 mentions a temperature of 62° C. for the south and an average temperature of only 78° C. for the north-west fumaroles in July 1943.

From written evidence found in the Kibo hut book, I mention that of Lieutenant I. H. Ash, dated October 17, 1943. He "found no cause to put in further pegs to demarcate fresh volcanic activity". "Personally," he wrote, "I should hesitate to say the crater is becoming increasingly active to the point of eruption."

The above data are sufficient to suggest a striking decrease of activity between 1942–43 and 1945.

A fact worth mentioning is the seismic activity reported from Kilimanjaro at the end of 1943 and in the first months of 1944. Two tremors felt at the Kibo hut were recorded by several mountaineers. One, a vertical shock, took place on January 17, 1944 (report by Miss E. Lany). Another fairly strong one in the night of February 21–22 at the Kibo hut (report by Dr. Bucher) was noticed simultaneously at Peters' hut (report by guide Johane). More reports of tremors reached me during the beginning of 1944. Four of these were felt at Mashame, south-west of Kibo. The first occurred in mid-December 1943, the second in the night of January 10–11, 1944, the third in the night of January 28–29, 1944 (reports by Dr. Reusch), and a short tremor was felt at Mashame by Mr. R. Cunningham on April 9, 1944. These tremors were not reported from other localities in the vicinity of Kilimanjaro and were apparently local. At the dates mentioned, only microseisms, varying from extremely slight to slight, were recorded by the seismograph at Entebbe, often at different hours from the Kilimanjaro shocks. The epicentres of the local shocks are unknown, but may well have been on Kilimanjaro itself. This seismic unrest ceased as suddenly as it had started, and no new reports have come in during the last twelve months.

In January 1944 news came through that after the tremor of mid-December 1943 and the one of January 10–11, 1944, one or more long radial crevasses had been seen, from a distance, in the north-west glaciers of Kibo. Longitudinal or radial crevasses, apart from those appearing when a glacier, having been squeezed in a narrow bed, spreads out again, are most unusual. To see what had happened, I undertook an ascent from Mashame, between January 31 and February 4, 1944, along Jeager's route of 1906. A fissure such as reported could only have occurred in conjunction with tilting movements of the strata

under the glaciers on the north-west flank of Kibo. During an extensive tour (which will be described elsewhere) nothing of an alarming nature such as disturbances of tectonic or volcanic origin could be detected. A rocky spur newly denuded of ice and snow was, however, apparent. This spur, about 500 yd. long, could easily be mistaken for a fissure in the ice, when seen at a certain angle, from a great distance. It was situated between Drygalski and Credner glaciers to the north of another patch bare of snow, above Penck glacier, where not long ago only a rock appearing through the ice, known in the past as Ravenstein, was in existence. These denudation effects are caused by the increasing rate of the diminution of the glaciers, a well-known phenomenon, as Meyer, Jeager, Klute, Gillman, Geilinger and others have pointed out during the past forty-five years. They are quite natural features in the prevailing climatic circumstances.

Observations on Kibo, both meteorological and volcanological, are continuing, and it is hoped that more data, together with those obtained from other volcanoes in East Africa, will prove useful in the future.

EMBRYOLOGY OF ANGIOSPERMS AS A FIELD FOR RESEARCH*

By Dr. P. MAHESHWARI

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IN the history of angiosperm embryology there have been three distinct periods : the first, in which the chief aim was to unravel the chief facts regarding the development of the pollen and embryo sac, and the processes of fertilization and seed formation ; the second, in which interest centred largely round a study of comparative embryology and an evaluation of the data thus obtained for the improvement of the existing systems of classification ; and the third and latest in which embryology has become an experimental subject like cytology and physiology, where one tries to study the optimal conditions for the storage of the pollen and its germination ; the receptivity of the stigma, fertilization and fruit-setting and how far the normal processes of development can be influenced or altered by a change in the environment.

Descriptive Embryology

Most of our facts relating to the course of development of pollen, embryo sac, endosperm and embryo became clear towards the close of the last century through the researches of Amici, Schleiden, Hofmeister, Strasburger, Treub, Guignard, Nawaschin and others, and are now a commonplace in all text-books of botany. Very good summaries of this work were given by Coulter and Chamberlain[1] and Schnarf[2]. Little that is fundamentally new has been discovered during recent years, but there were several errors and misinterpretations made by previous workers which have been corrected and a mass of valuable information added regarding the structure and development of the male gametes, the types of embryo sac development, the process of fertilization, the origin and function of the endosperm haustoria and the development of the embryo[3]. Further work of this type would be welcome ; but results of greater value are to be obtained if attention is now focused on a comparative study of only one aspect of the life-history at a time, namely, male gametophyte, embryo sac, pollen tube, apomixis, polyembryony, the role of the endosperm in embryonal development, etc. Each of these requires the study of a vast amount of literature and often a technique somewhat different from that used for the rest. Finn's work in the Ukraine on the male gametophyte and that of Souèges in France on embryogeny are notable examples of what can be achieved by this method.

Phylogenetic Embryology

In the second period, which may be said to have commenced with the beginning of this century, embryology began to be used as a tool for the improvement of the existing systems of classification, the most important contributions in this line having come from Sweden, Germany, Austria and the United States. A great impetus was given to such studies by the publication of Schnarf's handbook entitled "Vergleichende Embryologie der Angiospermen", in which the author has summarized the existing state of our knowledge of the embryology of each family and added a number of valuable suggestions and comments at the end of each order.

That embryology can be a valuable tool for the systematic botanist may now be considered as established beyond doubt, for if we assume phyletic trends in the external morphology of the flower it is only natural to expect them also in such internal structures as pollen grains, embryo sacs, endosperm and embryo. Indeed, as a very competent embryologist[4] has recently remarked, the resemblances and differences in the embryological characters of the members of a family, although sometimes of such a fine type that they cannot be brought out either in words or in drawings but can only be appreciated under the microscope, are nevertheless of distinct value in delimiting the smaller groups and in determining their interrelationships within each order.

To mention certain specific instances where embryology has rendered an important service in the determination of the proper position of a family, we may first take the Empetraceæ, a family which has been placed by some authors in the Sapindales, by others in the Celastrales and by still others in the Monochlamydeæ. Samuelsson's work[5] has definitely shown, however, that its proper place is with the Bicornes, a group characterized by a number of well-marked embryological features which are also seen in the Empetraceæ : (1) presence of a fibrous layer in the anthers ; (2) presence of a glandular tapetum which does not become amœboid ; (3) pollen grains remaining together in tetrads ; (4) ovule with single integument and an ephemeral nucellus which disappears in later stages so that the embryo sac lies in direct contact with the integumentary tapetum ; (5) absence of parietal cells in the ovule ; (6) embryo sac of the monosporic eight-nucleate type with small ephemeral antipodals ; (7) a fluted hollow style which connects the lumen of the ovary with the outside and along which the pollen tubes make their way into the ovary ; (8) a cellular endosperm, with the first two divisions transverse and giving rise to a row of four cells placed one above the other ; (9) the formation of endosperm haustoria at both ends of the embryo sac, micropylar as well as chalazal ; (10) a single-layered seed-coat formed

* Abridged and modified from the presidential address delivered to the Indian Botanical Society, January 1945.

from the outermost layer of the integument, the remaining layers becoming absorbed during the growth of the embryo sac and embryo. There is no doubt that Samuelsson established his point of view fully and completely, and Hutchinson's[6] assignment of the Empetraceæ to the Celastrales is incorrect.

Without going into details it may be further mentioned that on embryological and perhaps on other grounds as well the Lennoaceæ, which have sometimes been placed in the Bicornes[6], should be removed to the Tubiflorales[7], the Cactaceæ are best classed under the Centrospermales[8], the Podostomaceæ and Hydrostachyaceæ under the Rosales[9], the Moringaceæ under the Rhœadales[10] and the genus *Trapa* in the family Hydrocaryaceæ apart from the Onagraceæ. Recently, Schnarf[11] and Wunderlich[12] have suggested a number of rearrangements of the tribes and subtribes within the family Liliaceæ, which deserve the notice of the taxonomist. Space forbids a reference to several other works of a similar nature.

What has been written above is enough to show that with the main lines of latitude and longitude chalked out by the systematist it is possible for the embryologist, in co-operation with the cytologist and anatomist, to use this as a background and to help him in his work. Once a group has been assigned to its true place, every character that is studied will only serve to strengthen its position. On the other hand, if there are any discrepancies, they will be brought out in a more glaring fashion by the study of its internal characters (as these are less influenced by the environment) than the external.

There is great scope for phylogenetic embryology, as there are several families which have so far received little or no attention from this point of view. Special mention may be made of the following: Casuarinaceæ, Garryaceæ, Loranthaceæ, Balanophoraceæ, Aristolochiaceæ, Nymphæaceæ, Ceratophyllaceæ, Berberidaceæ, Magnoliaceæ, Myristicaceæ, Fumariaceæ, Droseraceæ, Zygophyllaceæ, Simarubaceæ, Callitrichaceæ, Burseraceæ, Hippocrateaceæ, Bombacaceæ, Sterculiaceæ, Salvadoraceæ, Dilleniaceæ, Dipterocarpaceæ, Flacourtiaceæ, Cornaceæ, Ebenaceæ, Myrsinaceæ, Pandanaceæ, Najadaceæ, Cyperaceæ, Palmaceæ, Cyclanthaceæ, Lemnaceæ, Flagellariaceæ, Xyridaceæ, Eriocaulaceæ, Stemonaceæ, Hæmoderaceæ, Dioscoreaceæ, Zingiberaceæ, Marantaceæ, Triuridaceæ and others. It is quite possible that a detailed knowledge of the embryology and internal structure of these families will in some cases give a new orientation to our ideas of their relationships.

Applied and Experimental Embryology

Coming now to the comparatively new field of experimental embryology, we find that the main directions in which work is being undertaken are: a study of the viability of the pollen and the optimum conditions for its storage and germination; the receptivity of the stigma; the rate of pollen tube growth under different conditions of temperature and humidity; the influence of external conditions on the interval elapsing between pollination and fertilization; the influence of X-rays, heat and chemicals upon the normal course of development; the induction of artificial parthenogenesis and parthenocarpy; and the culture of excised embryos *in vitro*. Considerable work on these lines is being done in the United States and the U.S.S.R. regarding the immense value of which in our breeding programmes there can be no question. We may hopefully envisage the possibility of having one or more 'pollen banks' in each country, where pollen of almost every plant of economic value will be stored under optimum conditions and supplied to recognized workers *gratis* or on a moderate charge. We shall be able to control sterility and unfruitfulness caused by premature or delayed pollination, a slow growth of the pollen tube or other similar causes. The culture of excised embryos under aseptic conditions has been of great help in overcoming the sterility which is inherent in certain interspecific hybrids as shown by the abortion of the embryos at an early stage of development if allowed to remain inside the ovule. This has given a new hope to the plant breeder for the creation and full development of many forms which were genetically possible but unobtainable due to other reasons.

Summing up, the embryology of angiosperms offers abundant scope for research not only on the descriptive side, which has not yet been exhausted, but also for the solution of many vexed phylogenetic problems and as an aid to the work of the plant breeder. In this last respect it comes in close contact with cytology and physiology and promises to be a study of great importance in the near future.

[1] Coulter, J. M., and Chamberlain, C. J., "Morphology of Angiosperms" (New York, 1903).
[2] Schnarf, K., "Embryologie der Angiospermen" (Berlin, 1929).
[3] Wulff, H. D., and Maheshwari, P., *J. Ind. Bot. Soc.*, **17**, 117 (1938). Maheshwari, P., *New Phyt.*, **36**, 359 (1937). Maheshwari, P., *J. Ind. Bot. Soc.*, **20**, 229 (1941); Johansen, D. A., "Plant Embryology" (1945) (in the press).
[4] Mauritzon, J., *Lunds Univ. Arsskrift, N.F. Avd.*, 2 (35), 120 (1939).
[5] Samuelsson, G., *Svensk bot. Tidskr.*, 1, 97 (1913).
[6] Hutchinson, J., "The Families of Flowering Plants", vol. 1 (London, 1926).
[7] Copeland, H. F., *Amer. J. Bot.*, 22, 366 (1935).
[8] Neumann, M., *Oesterreich. bot. Z.*, **84**, 1 (1935).
[9] Mauritzon, J., *Akad. Abh. Lund*, 152 (1933).
[10] Puri, V., *J. Ind. Bot. Soc.*, **20**, 263 (1941).
[11] Schnarf, K., *Sitzb. d. Akad. d. Wiss. Wien, math.-nat. Kl.*, 138, Abt. 1, 69 (1929).
[12] Wunderlich, R., *Flora, N.F.*, 32, 48 (1937).

THE GEOGRAPHER AS HUMANIST

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IT is no longer possible, as in earlier days, for the individual researcher to investigate with equal facility all aspects of geography. Inevitably, as in other expanding branches of learning, there is concentration of effort in specialized directions, involving the inevitable risk that the essential unity of the subject and the effective inter-relations of its parts may be impaired. The complete geographer, like the complete historian, does not exist; though many a geographer of the generation which is now passing, by reason of his supposed range of interests, has been expected to qualify for the role.

Three recent papers in *Nature*[1], devoted to the purpose and method of geographical investigation, included particular reference to political geography, because of its special significance in a period of international crisis and widespread frontier changes. The political and the economic are the two humanistic aspects of geography which have most attracted attention, though there has been diffidence on the part of those concerned in providing a thorough-going

presentation of the principles on which investigations have been made. If, however, the elucidation of political geography on its philosophical side is still without its proper place in the literature of the subject, what is to be said regarding the position of social geography, for which no statement of concepts of acknowledged orthodoxy exists! It is not surprising that confusion in teaching results, and that the social aspect of geography is occasionally identified with social anthropology which, in one guise or another, has sometimes been taught as 'human' geography.

Like every aspect of the subject, the physical as well as the humanistic, social geography is concerned with the spatial arrangement or pattern over the world of certain phenomena—in this case the phenomena which are of social, as distinct from political and economic, significance to man. They are treated, not in isolation, but in their interacting relationships with the total environment of man—an environment subject to, and undergoing constant transformation. Environment comprises not only the pattern of terrestrial phenomena within the habitat of man, in so far as they remain unaffected by human agency, but also the 'cultural landscape' which man has fashioned, with or without a plan, during his occupation. We think, for example, of the almost complete removal of the original forest-cover of western Europe in fairly recent historic time, and of ensuing agricultural and industrial utilization. Debate may long continue regarding the extent to which man, in his planned utilization of land, is subject to geographical controls: but it is generally accepted that his initiative is permitted adequate scope within the range of possibilities available at a given time. So much is agreed, even by those who contend that, in the realm of thought, man has the power to liberate himself from restrictions imposed by environment.

The most obvious transformation of environment by human agency is that which results from exploitation of economic resources. Less obviously and directly, environment is transformed in response to the application of political ideas. Political geography is dependent, in large measure, on the readiness of communities to seek economic, social and political segregation by raising frontiers against each other. A world without such frontiers seems at present unattainable, though rather because of the conscious rejection of federation as a way of political life than because of insurmountable geographical barriers. Apart from the study of all that is involved in the alignment of frontiers, the political geographer considers the effects of the political partition of territory on the life of the communities concerned. The selection of the site of a national capital, the geographical pattern of a national network of communications—these are two obvious examples of response, exemplified in every country, to the geographical limitations and opportunities imposed or offered by existing frontiers.

The manifestations of social life which contribute to the sum-total of human environment include, *inter alia*, the geographical distribution of population and of urban and rural settlements. In every continent, population is becoming more and more concentrated in large towns, with revolutionary consequences for social life. This is as true of oriental as of occidental civilization, as trends in urban growth in Britain, the United States of America, the Soviet Union, and Japan illustrate particularly well. The study of towns from the point of view of social geography is still in its infancy in Britain. It is but one aspect of an investigation which embraces the characteristics and relationships of all types of settlement, ranging from the city to the hamlet. In view of the present urgency of regional and town planning, it is not surprising that the geographer has received during the War a degree of official recognition unknown before. In his approach to the study of settlements, he recognizes that they are subject to an endless process of change, which may be one of either growth or decay according to trends prevailing within the region concerned. It is the dynamic quality in social, as in other aspects of geography, which most strongly appeals to the student of contemporary affairs.

Inseparable from the study of settlements is the geographical pattern of population distribution. It exerts a powerful influence upon the structure and organization of society, and provides the geographer with impressive, though not always conclusive, evidence of the comparative advantages for human occupation offered by the various regions of the world. Unfortunately, man is not free to settle the areas which are both geographically accessible and well-endowed by Nature. Political and social impediments, such as restrictive immigration laws, exist to arrest a natural tendency to migration from congested to emptier lands available for settlement. How to ensure that the population of a given area shall be, in density, neither excessive nor inadequate, taking into account both existing resources and their intended use, is the question on the answer to which social and economic planning largely depends. Such demographic terms as 'low' and 'high density' are frequently employed without reference either to prevailing social and economic standards or to comparative densities in other parts of the world, where similar geographical conditions prevail. There is obviously little value, from the geographical point of view, in comparisons of population density between communities of widely different social experience and habitat. A degree of density which is accepted as high for tropical Africa would be low according to Western European standards, even when comparison is restricted to non-industrialized areas of both zones. The fast-increasing 'urbanization' of population in every continent might suggest an approach to ultimate demographic uniformity throughout the entire world: but contrasts in population density between one region and another are assured for all time, if only because of wide variation between regions in regard to the economic possibilities that exist.

So far our reference to social geography as omitted the interaction between environment and manifestations of social intercourse, such as language and religion. To what extent do the geographical conditions of man's habitat intervene to affect the shape of human relationships? The fashion, not unknown among sociologists and economists, of studying society as if it existed in a geographical vacuum, is passing. Increasingly it is recognized that it is impossible to approach the study of society without reference to the territory on which its existence depends and with the horizons of which its traditions are harmonized.

Investigation of the inter-relations of the members of such comparatively primitive societies as the hunting-groups of Africa or the nomadic pastoralists of the steppes has usually welcomed the contribution of the geographer. It is quite unnecessary, however,

for the latter to devote over much attention to the traditional social pattern of such peoples, in view of the rapidity with which, under pressure of new impacts, their social and economic experience is being transformed. It is now difficult to point to any part of the world where the life of primitives has not been revolutionized within the last half-century, through contact with peoples of contrasted, and generally superior, social and economic *techniques*.

Until recently, the Tatar-Mongols had maintained, almost unchanged for countless generations, their traditional social standards. Life had become stereotyped in its association with a grassland environment, which had known no important change throughout human time, save fluctuations in the abundance of natural pasture. The pastoral societies which, some decades ago, the French geographer, Demolins[2], described as peoples "without a history" have, in our time, grown accustomed to the complex social conditions of newly industrialized cities, such as Tashkent and Stalingrad. The modern civilization of the Euro-Asiatic steppe provides a particularly vivid example of the power of geographically mobile ideas to transform, by planned selection of available possibilities, an environment hitherto regarded as hostile to, and immune from, change.

The geographer recognizes that social organization, in so far as it is affected by geography, is a response, not only to local environmental conditions, but also to the degree of intimacy which exists between one region and another. Prof. Schrader's Herbertson Memorial lecture[3] of 1919 discussed the imperative need for the establishment of equilibrium between environment and society, and pointed to the temporary absence of such equilibrium over large parts of the continents as the principal cause of the world-wide social and political unrest of his time.

Search for evidence of the influence of environment on religion and language has had its appeal for one school of social geography. An earlier generation of environmentalists went so far as to advance geographical determinism in explanation of the Middle East zones of origin of the three great monotheisms —Christianity, Judaism and Islam. These religions, regarded as 'products' of a desert or semi-desert environment in each case, could not have arisen—according to the argument—under any other geographical conditions. Many, shocked by such doctrine, were yet prepared to admit that religious beliefs and practices are incomprehensible without reference to the social experience of the founder of the faith: which would seem to go half-way to the deterministic conclusion. Certainly each body of religious practices grows in association with a particular environmental setting, as George Adam Smith's classical work[4] offers impressive evidence. Moreover, when religious concepts spread from one region to another where social conditions are markedly different, they are inevitably modified in the process. Every religion of wide geographical range comprises, within its zone of influence, a diversity of concepts and practices which is intimately associated with the regional experience of its adherents.

Mere description of the distribution of religions and languages in terms of nations or political divisions is, in itself, a sterile enterprise. On the other hand, why their influence extends in certain geographical directions and not in others, why in certain areas they remain relatively 'pure' whereas in others they become 'mixed'—these are questions to the solution of which the geographer may be able to contribute from his knowledge of inter-regional associations. In these and other such inquiries it is the geographer's duty to ensure that the relationship of society with environment is not overlooked. Whether or not, on this basis, modern scholarship would concede the geographer's qualifications as a humanist, it should not be forgotten that by the Greeks of classical times he was accepted as such.

[1] *Nature*, **152**, 589 and 740 (1943); **153**, 481 (1944).
[2] Demolins, E., "Comment la route crée le type social" (Paris, n.d.)
[3] "The Foundations of Geography in the Twentieth Century" (Oxford. Univ. Press, 1919).
[4] "The Historical Geography of the Holy Land" (16th ed., London, 1910).

RECENT BIOLOGICAL WORK IN FINLAND

By Dr. G. H. BEALE
John Innes Horticultural Institution

DURING the War readers of *Nature* will have had little or no access to Finnish scientific publications; nor under present conditions is it to be expected that there will be a rapid resumption of the exchange of periodicals in Europe. Consequently it is hoped that the following brief summary of recent Finnish biological work will be of value. A large quantity of material was kindly supplied to the author by Profs. R. Collander, H. Klingstedt and others. Space will not permit of the reproduction of more than a small proportion of this material; in particular, records of applied work have been omitted, and of the mass of descriptive studies, only the most cursory mention can be made.

Finland is one of the few countries in Europe in which the vegetation over large areas has been comparatively little disturbed by agriculture or urban development. It therefore affords suitable terrain for the study of plant ecology and plant geography, and in fact a large number of papers have appeared on these subjects in recent years. Taxonomy also claims considerable attention in Finland, owing to the strong Linnæan tradition. Progress in other branches, however, may be attributed to the enthusiasm of certain individual workers; for example, there is the plant physiological work on permeability at the Botanical Institute, Helsinki, under the direction of Prof. R. Collander, the biochemical work on nitrogen fixation in Prof. A. I. Virtanen's department[1], the cytological work in Prof. H. Federley's Genetical Institute, the animal physiological work under the direction of Prof. Paavo Suomalainen, and Prof. Pontus Palmgren's well-known ornithological studies. All these departments have been able to continue their work to some extent during the war years, though the Botanical Institute in Helsinki has suffered some bomb damage.

Plant Physiology

The plant physiological work of Prof. Collander's department is at present mainly concerned with two problems: (*a*) quantitative determinations of the permeability of plant protoplasts to dissolved substances, and (*b*) the active uptake of mineral salts by plant cells. V. Wartiovaara[2] has studied the effect of temperature on the rate with which eight different non-electrolytes exosmose from the giant cells of *Tolypellopsis stelligera* (Characeæ). He found

a pronounced effect of temperature on the rate of permeation of these substances, the Q 10 being between 2·5 and 5·5 except for hexamethylene tetramine, where it was as high as 9. The temperature coefficients were found to be independent of lipoid solubility and permeation power of the substance used; but substances with smaller molecules, such as urea, ethylene glycol, urethylan, had lower Q 10's than substances with larger molecules.

Wartiovaara[3] has also studied the permeability of cells of *Tolypellopsis* to heavy water and methyl alcohol. These substances were found to permeate at approximately the same rate, and about two hundred times as fast as urea or twenty thousand times as fast as glycerol. It was also found that methyl alcohol permeates about ten times faster than substances of approximately the same relative lipoid solubility but greater molecular size, while heavy water permeates several hundred times faster than substances of corresponding lipoid solubility but greater molecular size. Molecular size is therefore a very important factor in permeation power in the case of extremely small molecules.

R. Collander, H. Lönegren and E. Arhimo[4] have found that neutral red, a rapidly permeating basic dye, permeates into the epidermal cells of *Allium* approximately twenty thousand times faster than urea, a non-electrolyte, in spite of the greater size of the neutral red molecules.

Collander[5] has also been investigating the selective absorption of various cations by higher plants, by growing some twenty species of phanerogams in nutrient solutions containing several cations in equivalent amounts, and afterwards determining the cation composition of the plants by Lundegardh's method of quantitative spectral analysis. It was found that rubidium and cæsium were taken up in approximately the same amounts as potassium; similarly strontium was taken up in the same amount as calcium. Thus the plants were unable to distinguish between potassium, rubidium and cæsium, or between calcium and strontium.

Collander[6] has also studied the distribution of several cations between root and shoot, and found that some cations (potassium, rubidium, cæsium) are approximately uniformly distributed; but that sodium and manganese in most species occur in higher concentrations in the root, and calcium, strontium and lithium in the aerial parts of the plant.

Animal Physiology and Developmental Mechanics

Paavo Suomalainen[7] has continued his investigations into the physiology of hibernation in hedgehogs. Arising out of the results reported in *Nature* in 1939, when he showed that hibernation could be artificially induced by injecting hedgehogs with insulin and putting them in the cold, Suomalainen has now found that the islands of Langerhans in the pancreas are hypertrophied during hibernation. He has also discovered that adrenalin secretion is much decreased during hibernation.

Osmo Tuurala[8] has been studying the movement of the pigments in the eyes of various Lepidoptera, which can be classified into at least five types according to their behaviour in this respect. In types considered to be primitive there is movement only of the iris pigment, while in more advanced types there is movement of other pigments also, namely, the retinula pigment, the pigment of the basal cell of the retinula (this moves in the opposite direction to the other pigments), and finally of the cell nuclei themselves. The primitive type is found only among night-flying Lepidoptera; dusk- and day-flying insects have the more advanced types.

Sykkö Pesonen[9], studying the nutrition of the hedgehog embryo, has found that during pregnancy, the corpus luteum secretes a hormone which is essential for the histiotrophic type of nutrition. This has been confirmed in mice also, by Annikki Vaalanto (unpublished).

Sulo Toivonen[10] has been investigating the *specific* induction effects obtained by implanting into newt gastrulæ small pieces of tissue from an unrelated species. Thus liver tissue from perch, guinea pig or viper (previously killed by treatment with alcohol) induced almost exclusively organs belonging to the anterior part of the head (anterior brain, nose, eyes, balancer). Kidney tissue from perch and guinea pig induced organs which in normal development occur in the posterior part of the body, from the ears backwards, especially secondary tails. Bird and viper kidney tissue, however, induced organs normally found in the posterior part of the head, that is, mid brain and posterior brain. Thymus gland tissue from the guinea pig often induced eye-lenses, a highly specific effect.

In a later publication, Toivonen[11] has reported on experiments with thymus gland tissue from guinea pigs of different ages, from which it is seen that the lens-producing substance predominates in four-months old thymus (or slightly younger), while in older glands the relative quantities of other substances increase.

Cytology and Genetics

Esko Suomalainen[12,13] has been continuing his study of the interrelation between parthenogenesis and polyploidy in the Otiorrhynchinæ and Brachyderinæ (weevils), and Blattoideæ (cockroaches). He has found that of the nine Finnish parthenogenetic weevils, there are one diploid, five triploid and three tetraploid species; while the bisexual species are all diploid ($2n = 22$). Suomalainen also reports a curious *gonomery* in the ripe eggs of some parthenogenetic species of weevil; for example, in a tetraploid species the different sets of chromosomes sometimes remain in separate groups—11 in one plane, 22 in another, 11 in a third; or 33 in one plane and 11 in another, etc.

Tarvo Oksala[14], studying meiosis in eight species of the dragon-fly *Aeschna*, has found that at spermatogenesis each bivalent normally contains one fully terminalized chiasma, while at oogenesis there are two chiasmata per bivalent, at opposite ends. There is a single X-chromosome in the male, which is sometimes attached to one of the autosomes, and always divides at the first meiotic division; a chiasma is never formed between the X and the medially situated centromere. On the basis of these studies, Oksala puts forward the unorthodox view that the first maturation division is an 'equational' one, at which the centromeres divide.

Prof. H. Federley[15], carrying on his long-continued cytogenetic researches on species and race hybrids in the Lepidoptera, has reported an unexpected chromosome situation in the hybrid between the European *Dicranura vinula* ($n = 21$) and the African *D. delavoiei* ($n = 31$). Both at spermatogenesis and oogenesis, at the first and second meiotic metaphases, only twenty-one (or sometimes a few more) chromo-

[None of the vacancies in these columns relates to a Man between the ages of 18 and 50 inclusive or a Woman between the ages of 18 and 40 inclusive, unless he or she is excepted from the provisions of the Control of Engagement Order, 1945, or the vacancy is for employment excepted from the provisions of that Order.]

THE INSTITUTION OF CHEMICAL ENGINEERS

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Application forms (returnable December 1, 1945) and particulars of the Associate-Membership Examination for 1946 may be obtained from the Hon. Registrar, Institution of Chemical Engineers, 56 Victoria Street, Westminster, London, S.W.1.

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GEOLOGY DEPARTMENT

Technical Assistant required for the laboratory staff of the above Department. Neither geological nor previous laboratory experience is absolutely necessary, but applicants must be neat-handed, adaptable and interested in precise practical scientific work. If necessary, training will be provided in such operations as rock-sectioning and micro-photography. Salary £3 to £5 per week according to age and qualifications.

Applicants should write to Professor L. J. Wills, Geology Department, University, Birmingham, 15, stating present employment, experience and qualifications.

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Applications are invited for the above Fellowship. Subjects: Physics, Chemistry and Mathematics or any one of those subjects. Annual value not less than £375 per annum (N.Z. currency). Full particulars in University Calendar. Application forms are available from the Secretary, Universities Bureau of the British Empire, c/o University College, Gower Street, London, W.C.1. Closing date for receipt of applications in New Zealand, January 31, 1946.

UNIVERSITY OF LONDON

GRANTS FOR RESEARCH

Applications are invited from members of the University for grants from the Central Research Fund for assisting specific projects of research and for the provision of special materials and apparatus. Applications will be considered three times a year and must be received not later than March 31, July 31 and November 30. Forms of application and further particulars may be obtained from the Academic Registrar, University of London, at Richmond College, Richmond, Surrey.

MARINE BIOLOGICAL ASSOCIATION OF THE UNITED KINGDOM

The Council of the Association invites applications for the post of Physiologist at the Plymouth Laboratory. The commencing salary will be according to the qualifications of the candidate selected, and will be between £500 and £700 per annum (plus War Bonus), with annual increments of £25. The post entails membership of the Federated Superannuation System for Universities.

Applications should be sent to the Secretary of the Marine Biological Association, The Laboratory, Citadel Hill, Plymouth, not later than October 31, 1945.

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Applications (5 copies), with copies of two testimonials and names of three referees, should reach the Institution of Automobile Engineers, Research Department, Great West Road, Brentford, Middlesex, not later than October 20, 1945, addressed to the Chairman and marked "Director of Research".

Agricultural Specialist wanted by major Oil Company for service in South America; knowledge of Spanish desirable but not essential. Should have a degree in Agricultural Science, preferably Agricultural Chemistry, and have considerable practical experience, particularly in fertilizers and pest control. Age preferably 26–35. Salary £750–£1,000 per annum, depending on age and experience, but are prepared to consider applications from experienced retired Colonial Agricultural Officers. Write, giving full particulars of age, qualifications, and previous experience, to Box 411, T. G. Scott & Son, Ltd., 9 Arundel Street, London, W.C.2.

Imperial Chemical Industries Limited, Billingham Division, has a vacancy for a Patent Agent or qualified Assistant with experience of German and U.S. practice in addition to British practice. Candidates should have an Honours degree in Chemistry or Engineering with a working knowledge of German. Salary according to qualifications. Enquiries should be addressed to the Research Director, Imperial Chemical Industries Limited, Billingham Division, Billingham, Co. Durham.

For Sale: Colony of about 300 white Breeding rats together with cages. Can be viewed by appointment at East Croydon. Write Box 404, T. G. Scott & Son, Ltd., 9 Arundel Street, London, W.C.2.

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Electronics Engineer required for large Industrial Research Laboratories specializing in research on engine fuels and lubricants. Good Honours degree in Physics or equivalent plus subsequent research experience desirable. Salary according to qualifications and experience. Reply, stating age, qualifications, experience and when available to Box 408, T. G. Scott & Son, Ltd., 9 Arundel Street, London, W.C.2.

Science Editor. Well-known firm of Educational Publishers requires full-time services of Graduate to prepare Science and other textbooks for the printer. Some teaching experience desirable; knowledge of proof reading and printing processes essential. Permanent post entailing residence in Cambridge. Write, stating qualifications, age and salary required, to Box 388, c/o John Hart & Co., 22 Northumberland Avenue, W.C.2.

Laboratory Steward required immed- iately to take charge of Biology Laboratory. Experience essential. Salary £190–£240 (increments £12 10s.) £240–£250 (increment £10) plus war bonus approximately £60. Applications in writing to the Head of the Department of Chemistry and Biology, The Polytechnic, 309 Regent Street, W.1.

Slumberland Ltd. and their associated companies will shortly require a variety of Research and Development Assistants in their newly formed Research Department in the Manchester area. Commencing salary £500 to £750, according to qualifications and experience. Applications to Director of Research, Box 410, T. G. Scott & Son, Ltd., 9 Arundel Street, London, W.C.2.

Spectroscopist required for Research Laboratory. Training and practical experience in infra-red work essential. Reply stating age, qualifications, experience and when available to Box 409, T. G. Scott & Son, Ltd., 9 Arundel Street, London, W.C.2.

Hollerith Operator required to take charge of, and develop, a Holerith Unit in West London area. Salary up to £400 per year depending on experience and qualifications. Applications, stating age, experience, etc., to Box 407, T. G. Scott & Son, Ltd., 9 Arundel Street, London, W.C.2.

Librarian wanted for Research Labor- atory in West London area, with skill and experience in classification and U.D.C. Salary £5 to £6 per week depending on experience and qualifications. Applications, stating age, experience, etc., to Box 406, T. G. Scott & Son, Ltd., 9 Arundel Street, London, W.C.2.

Patent Attorney required by old-estab- lished Dominion firm take charge mechanical, some electrical, specification section. Highest character and capacity necessary. Position offers excellent remuneration and conditions. Furnish full statement and references to Box 405, T. G. Scott & Son, Ltd., 9 Arundel Street, London, W.C.2.

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some 'units' are seen. In other hybrids in the same genus the number of chromosomes approaches the sum of the haploid numbers of the parents, since pairing at meiosis is very weak. Federley[16] has discovered a natural population of *Pygæra pygra* in which spermatocytes with the diploid number of chromosomes occur frequently. He is also preparing a general survey of chromosome numbers in the Lepidoptera.

E. Pfaler-Collander[17] has made a comprehensive cytological study of forty-five species of bugs of the family Lygæidæ and includes in her paper the novel feature of a key for the determination of the species by means of the numbers and relative sizes of the chromosomes.

Esko Suomalainen (unpublished) has made some observations on the inheritance of aneury in cats. He finds that it is due to a single gene, lethal when homozygous.

General

Space does not allow any account of the numerous publications on plant taxonomy, geography and ecology which have appeared in Finland during the War. Taxonomists will, however, be interested to learn of the completion of the monumental "Plantae Finlandiae exsiccatae a Museo botanico Universitatis Helsingforsiensis", by Harald Lindberg, which now comprises no fewer than 1,457 species. G. Marklund[18] has continued his investigations into such apomictic groups as *Taraxacum*, adding some thirty-two new Finnish species to those already known, making more than two hundred in all, and *Ranunculus auricomus —R. cassubius*, of which several tens of microspecies occur in Finland.

During the War more than eighteen papers on plant ecology or geography have appeared. Among them may be mentioned I. Hustich's work on the influence of climate on the forest limit, a subject of obvious importance in a country in which timber is of such enormous economic significance.

Prof. Pontus Palmgren and his collaborators have been carrying on their extremely careful and patient observations on the behaviour of birds. Among other studies, Palmgren[19] has investigated the day-and-night rhythm of migratory birds (for example, robins and thrushes) in captivity. He has found that during the winter and summer, the birds move about during the morning and evening; while in the spring and autumn (the migration seasons), they move about at night. (Migration takes place at night.) Palmgren also has noticed individual peculiarities of each bird, which remain very constant.

Prof. O. Kalela[20,21] has been continuing his studies on population dynamics of mammals (such as lemmings) and birds (such as grouse).

Finally, some interesting work on insect ecology, inspired by the pioneer investigations of R. Krogerus, is in progress. Such, for example, is E. Palmen's study of the immense clouds of insects, containing some quite foreign species, which from time to time drift over the coast of Finland.

In conclusion, it is with regret that one must record the deaths of F. Elfving (1854–1942), who was for so long head of the Botanical Institute of the University of Helsinki and was the first plant physiologist in Finland; K. Linkola (1888–1942), well known for his work on the influence of culture on the vegetation and flora of the district north of Lake Ladoga; and A. K. Cajander (1879–1943), author of the theory of forest types.

[1] *Nature*, **155**, 747 (1945).
[2] *Ann. Bot. Soc. Zool.-Bot. Vanamo*, **16** (1942).
[3] *Acta Bot.*, **34** (1944).
[4] *Protoplasma*, **37** (1943).
[5] *Plant Physiology*, **16** (1941).
[6] *Acta Bot.*, **29** (1941).
[7] *Proc. Acad. Sci.*, **4** (1943).
[8] *Ann. Entomol.*, **11** (1945).
[9] *Ann. Zool. Soc. Zool.-Bot. Vanamo*, **9** (1942).
[10] *Ann. Acad. Sci.*, Ser. A, **55** (1940).
[11] *Ann. Zool. Soc. Zool.-Bot. Vanamo*, **21** (1945).
[12] *Ann. Acad. Sci.*, Ser. A, **54** (1940).
[13] *Hereditas*, **31** (1945).
[14] *Ann. Acad. Sci.*, Ser. A Iv, **4** (1943); also unpublished.
[15] *Hereditas*, **29** (1943).
[16] *Acta Zool.*, **35** (1942).
[17] *Acta Zool.*, **30** (1941).
[18] *Acta Bot.*, **26** (1940).
[19] *Zeits. Tierpsychologie*, **6** (1944).
[20] *Ann. Zool. Soc. Zool.-Bot. Vanamo*, **8** (1941).
[21] *Ornis*, **21** (1944).

OBITUARIES

Dr. J. Davidson

THE unexpected death of Dr. J. Davidson, at the age of sixty, came as a shock to his many associates in Great Britain and in Australia.

Davidson graduated from the University of Liverpool in 1908, taking his D.Sc. degree in 1915. He worked as a research scholar at the Imperial College of Science and Technology, London, and with the Ministry of Agriculture, his work also taking him abroad to Paris, Berlin and Florence. He served during the War of 1914–18 as captain in the R.A.M.C., carrying on special entomological work particularly on the relations between mosquitoes and malaria. His work in Sinai was mentioned in dispatches.

In 1920, Davidson joined the staff of the Rothamsted Experimental Station in the newly formed Entomological Department under A. D. Imms. His work was concentrated on the biology of the bean aphis, *Aphis rumicis*, and he also collaborated with H. Henson in studying the effect of various chemical substances on aphis infestation. The materials were either injected or watered on to the sand in which the plants were grown, pyridine proving fatal to the aphids at strengths which were harmless to the plants. Observations in the course of this investigation led to the intensive work on the relation between boron and plants later carried out in the Botanical Department of Rothamsted. Besides numerous papers on the subject, Davidson published in 1925 an important monograph listing the British aphids.

In 1928, Davidson accepted the post of entomologist to the Waite Research Institute at Adelaide, Australia, and soon after was also appointed as professor of entomology at the University of Adelaide, holding both posts until his death. His Australian work again took a very practical bias, and during his first few years in the country, he dealt with a number of insect pests which were the cause of considerable economic loss. Thrips, Collembola, 'white grubs' (larvæ of beetles of the family Scarabæidea), eelworms, and other pests attacking pastures,

cereals and fruit came under investigation, and control measures were suggested. Later he gave considerable attention to locust and grasshopper outbreaks, arising from a widespread plague of grasshoppers in South Australia during 1933–35. This led to more generalized work on the ecology of insects, particularly in relation to climatic conditions, most of his later papers dealing with various aspects of this subject.

Soon after taking up work at Rothamsted, Davidson married Johanne Therese Hornemann, one of a very musical Copenhagen family. Three sons went out with them to Australia, a girl being born later. Their musical evenings at Harpenden will long be remembered by those who were fortunate enough to be invited. W. E. BRENCHLEY.

Mr. R. C. Porter

MR. RALPH CLASSON PORTER, for thirty-seven years senior lecturer in the Department of Mechanical Engineering, University of Birmingham, died at his home in Northfield on July 28, in his seventy-fourth year.

Mr. Porter was the son of the Rev. James Nixon Porter and was born at Heatley, Warrington, on August 14, 1871. He was educated at Clifton, and afterwards at the University of Liverpool, where he obtained a first class honours degree in engineering in 1892. After graduation he was for three years a premium pupil with Messrs. Beyer, Peacock & Co., Ltd., of Gorton, Manchester, and on completion of his pupillage spent a short time with the Belfast and Northern Counties Railway, obtaining running experience on the footplate. His enthusiasm for locomotives and locomotive engineering was to remain with him throughout his lifetime. For nearly four years after leaving the railway he was assistant manager of the rolling mills of the Frodingham Iron and Steel Company.

In 1899 Mr. Porter took up academic work and was appointed lecturer in engineering at the Polytechnic School of Engineering in Cairo. He left Cairo in 1901 when he was appointed lecturer in mechanical engineering at the University of Birmingham under the late Prof. F. W. Burstall. His experience in Cairo made him especially sympathetic and understanding of the difficulties of students from the East who studied at Birmingham.

In 1901 the Department of Mechanical Engineering was at Mason College, and it devolved upon Mr. Porter to design and lay out the engineering workshops and the power station for the Department in the new University buildings at Edgbaston. The power station was responsible for the supply of heat, electric power and lighting to the whole of the University buildings, and was in addition used as a heat laboratory. During the period 1914–18 the University buildings at Edgbaston were used as a military hospital, Mr. Porter being responsible for the maintenance and for the installation of the additional plant required. When normal conditions returned, he reorganized and re-equipped the Department on a new site near the power station.

Throughout his long career as senior lecturer and director of the power station, he took a keen and active part in University life, and until his retirement represented the non-professorial staff on the University Council.

He leaves a widow and two sons, his eldest son, who was a research engineer with the L.M.S. Railway, having predeceased him.

WE regret to announce the following deaths :

Dr. William Cramer, who was associated with the Imperial Cancer Research Fund during 1914–39, on August 10, aged sixty-seven.

Mr. R. A. Rye, Goldsmiths' librarian of the University of London during 1906–44, on September 14, aged sixty-eight.

Dr. B. O. J. Schrieke, delegate for the Netherland Indies at the United Nations Conference and formerly professor of social anthropology in the University of Amsterdam and later director of the Anthropological Section of the Colonial Institute, Amsterdam, aged fifty-five.

Prof. C. E. Spearman, F.R.S., emeritus professor of psychology in the University of London, on September 17, aged eighty-two.

NEWS and VIEWS

Research and Development in the United States

IN his message of September 6 to Congress, President Truman called for the establishment of a new Federal Agency to implement the recommendations of Dr. Vannebar Bush's recent report, "Science—the Endless Frontier" (see *Nature*, August 4). The development of atomic energy, said the message, is a clear-cut indication of what can be accomplished by the universities, industry and Government working together. Vast scientific fields remain to be conquered in the same way to derive the full profit in the future from what we have learned. The President urged upon Congress the early adoption of legislation for the establishment of a single Federal research agency which would discharge the following functions : promote and support fundamental research and development projects in all matters pertaining to the defence and security of the United States ; promote and support research in the basic sciences and in the social sciences, as well as in medicine, public health and allied fields ; provide financial assistance in the form of scholarships and grants for young men and women of proved scientific ability ; co-ordinate and control scientific activities of Federal departments and agencies ; and make fully, freely and publicly available to commerce, industry, agriculture and academic institutions the fruits of research financed by Federal funds. The message also called for an additional contribution of five hundred and fifty million dollars from the United States to the United Nations Relief and Rehabilitation Administration, and appealed for legislation for the early resumption of a vast programme of public works sponsored by the late President Roosevelt, urging that similar projects to the Tennessee Valley Authority should be undertaken for the development of the Columbia, Missouri and Arkansas Rivers and the central valley of California. "We shall seek," said the message also, "under the procedure prescribed in the lend-lease act and in subsequent agreements with other Govern-

ments, to achieve settlements of our war-time lend-lease relations which will permit, generally, a sound world-wide economy and will contribute to international peace and to our own national security."

Operational Control of Electricity Supply Systems

Supervisory equipment for the remote control of plant has proved to be thoroughly reliable and to facilitate efficient operation of electricity supply systems. In a paper read in London on March 14 by W. Kidd and E. M. S. McWhirter before the Institution of Electrical Engineers, the authors give the reasons for, and the steps taken to develop, the common-diagram control system, which enables an almost unlimited number of substations, etc., to be controlled completely from one diagram and control panel, and is sufficiently flexible to cater for the growth of an undertaking. It describes a wall-type system diagram which automatically indicates which substations have changed conditions, and therefore the area involved in any disturbance. The system diagram is equally extensible to accommodate new feeders and substations with a minimum of operating disturbances. Particulars of the circuits and apparatus, and comparisons of floor area, pilot and cost economies are given in the paper, together with information relating to an installation dealing initially with seventy-eight substations, to which others are being added.

The authors believe that, by the development of the ideas explained in the paper, the use of supervisory remote-control equipment has been extended on normal automatic-telephone switching practice to a wider application than was practicable with individual systems for large numbers of substations. This results in an economy of cost of equipment, of cost for control buildings, and of effort of the control staff. Operational control of large electricity supply systems will undoubtedly produce new requirements and problems as industrial, traction and domestic loads increase; but it is believed that, in the system described, a basis for meeting these requirements without adversely affecting present facilities has been provided.

Quaternion Centenary Celebration

The centenary of the discovery of quaternions by Sir William Rowan Hamilton has already been the subject of an article in *Nature* (**152**, 553; 1943). The Royal Irish Academy has now published (*Proc. Roy. Irish Acad.*, **50** A, 69; 1945) a record of the celebration in Dublin on November 8, 1943, which was attended by Mr. de Valera and two of his Ministers. Owing to the War, representatives of science from outside Ireland were unable to be present in person, but some of them sent messages or articles. The late Prof. G. D. Birkhoff of Harvard stressed the part that Hamilton's ideas played in the development of mathematics in the United States. Vectorial theory could be regarded as, to a large extent, latent in quaternions, like a fine melody in a great symphony. Vectors were more useful in classical physics, quaternions in the special theory of relativity, and tensors in gravitational relativity. Mathematicians and theoretical physicists should study all three with their historical development.

Sir Edmund Whittaker gave an account of the sequence of Hamilton's ideas, pointing out the gaps and apparent lack of harmony in existing accounts. With regard to Hamilton's recognition of the necessity for non-commutative multiplication, Whittaker says: "This was the supreme moment in the history of mathematical symbolism. It began the creative process which yielded not only quaternions, but all the other systems which broke away from the old rules —Cayley and Sylvester's matrices, Boole's symbolic logic, Grassmann's *Ausdehnungslehre*, Gibbs's dyadics, and the Heisenberg-Dirac algebra of quantum mechanics. Dr. A. J. McConnell dealt with the many distinguished members of Trinity College, Dublin, in the first half of the nineteenth century, including the mathematical physicists Hamilton, Lloyd, MacCullagh, Jellett and Haughton, the astronomer Brinkley, and the geometers Salmon, Booth, Hart, Charles Graves, Ingram and Stubbs. Dr. McConnell also printed the hitherto unpublished manuscript by Hamilton containing his first account of quaternions, written on the evening of the discovery. There are three other papers which demand more technical knowledge from the reader: "Quaternions and Matrices", by Prof. A. W. Conway; "A Modern Presentation of Quaternions", by Prof. F. D. Murnaghan, of Johns Hopkins University; and "The Icosian Calculus", by the Rev. J. R. Colthurst. The volume contains two plates: one a reproduction of an etching of Hamilton, the other a photograph of the first entry in his note-book of quaternion formulæ.

Mechanization of Sugar Beet Production

The Ministry of Agriculture, in agreement with the Ministry of Food, is sending a small mission to North America this autumn during the sugar beet harvest season to study progress there in research and development work on the mechanization of sugar beet cultivating and harvest. The party will consist of Mr. J. Bradley, principal scientific officer in charge of the engineering side of the National Institute of Agricultural Engineering; Mr. W. J. West, senior scientific officer on the agricultural side of the National Institute of Agricultural Engineering; Mr. F. E. Thornhill, agricultural officer from the British Sugar Corporation factory at Allscott, Salop; and Mr. H. S. Taylor, agricultural officer from the British Sugar Corporation factory at Brigg, Lincs. They will visit the principal growing areas in North America during harvest and will study practical operations in the field and in the factories in addition to the research and development work being undertaken by university centres, sugar factories and agricultural machinery manufacturers. It is hoped that the information and experience gained will be of considerable value to workers in this field in Great Britain, at a time when the problem of developing suitable machinery to meet the needs of British growers at the peak periods of cultivation and harvesting is of vital urgency. Special attention will be devoted to problems connected with the segmentation of sugar beet seed, the development of beet seed drills and the mechanization of sugar beet harvesting.

Narcotic Drugs

The two plants from which the raw materials of all the manufactured drugs covered by the International Conventions of 1925 and 1931 originate are the opium poppy and the coca bush. The former is used for the manufacture of morphine, heroin, codeine, dionine and other drugs, and the latter for the manufacture of cocaine. Unlike opium, coca leaves are little used in the form of medicinal preparations but are used in large quantities in the preparation of non-narcotic beverages. The Central Opium Board

of the League of Nations, in a 32-page report prepared by Mr. L. F. Atzenwiler entitled "Pre-War Production and Distribution of Narcotic Drugs and their Raw Materials" (New York: International Documents Service, Columbia Univ. Press. London: George Allen and Unwin, Ltd., 1944. 50 cents.) summarizes and analyses the mass of world-wide material which the Board has received. The report shows the importance of each country as a producer, and the quantities and methods of disposal of the raw materials and manufactured drugs, by both producer and consumer countries. The world productions of raw opium and morphine, for example, were 18,504 tons and 137,360 kgm. respectively during the period 1934–37. Although such details will chiefly interest technicians, the main facts, trends and conclusions should be of great value as basic material for those concerned with future international work in this field.

Treatment of Arterial Injuries

THE Medical Research Council's War Memorandum, No. 13 (H.M. Stationery Office, 1944), on "Arterial Injuries" has been prepared by the Vascular Injuries Sub-committee of the Council's War Wounds Committee. It is intended for those who have only a limited experience of the early treatment of arterial wounds. It carries the authority of the eleven leading British surgeons who sit on this sub-committee, and shows how far surgery has advanced in recent years. The pamphlet is divided into sections on anatomy, symptoms, treatment in forward battle areas or in hospitals where specific operative treatment is possible and on the management of limbs in which the circulation has been impaired. Appendixes deal with the technique of the suture of completely or partially divided arteries, the administration of heparin, the technique of blocking the sympathetic nervous system in the arm or leg and the writing of notes on vascular injuries. Primarily useful to surgeons, this pamphlet will no doubt interest others who may have to deal with this kind of injury in peace-time as well as in war.

Spicules on the Sun

THE March issue of *Sky and Telescope* contains a brief notice of solar spicules, which are very small spike-like prominences most commonly seen in the polar regions of the sun. They have previously been seen during solar eclipses; but the coronagraph makes it possible to carry out daily observations of their numbers and duration. Dr. Walter O. Roberts is in charge of the observations made at Harvard College Observatory's Fremont Pass station at Climax, Colorado, and he has found that the spicules last only four or five minutes from the time of detection until they fade out completely. A spicule is brightest just before it attains its full height, and after reaching its maximum elongation it begins to fade out without any perceptible motion. Their average width is about 4,500 miles and most of them are only a few thousand miles high. The largest spicule sometimes lasts eleven minutes, and some of the smaller ones about two minutes. At times as many as twenty-five spicules have been seen simultaneously in a 60° arc of the sun's polar limb. They are not seen in disturbed regions of the sun, and they show material flowing outward from the lower layers of the atmosphere; this is in contrast to the ordinary solar prominences, which show material when it is falling inward to the sun's surface.

Smithsonian Publications

THE Classified List of Smithsonian Publications Available for Distribution, May 1, 1925, compiled by Helen Munroe (Publication A.3802, Smithsonian Institution, Washington), contains only such works as can now be supplied by the Institution. It is not a complete list of all Smithsonian publications issued to date, and in particular publications of the United States National Museum and of the Bureau of American Ethnology are not included. The papers are arranged by subjects alphabetically, and the series in which they appeared are indicated. Those in the series of Contributions to Knowledge and Miscellaneous Documents are not public documents, but are available in printed editions and distributed without charge to public libraries, educational establishments and learned societies. They are supplied to other institutions and to individuals at the prices indicated. The Smithsonian Report volumes are distributed gratuitously to libraries and individuals throughout the world; but many of those of which the Smithsonian edition is exhausted can be purchased through the Superintendent of Documents, Government Printing Office, Washington. Applicants to the Institution should state the grounds for their request, as the Institution can only supply the papers as an aid to research or studies in which applicants are specially interested.

Announcements

THE Committee of Privy Council for Medical Research has appointed Prof. P. A. Buxton, professor of medical entomology in the University of London, and Sir Alexander Fleming, professor of bacteriology in the University of London, to be members of the Medical Research Council from October 1, 1945.

MR. J. STEWART COOK has been appointed organizing secretary of the British Association of Chemists as from July.

THE life and work of the late Major Charles E. S. Phillips, secretary of the Royal Institution during 1929–45, will be commemorated at a meeting at the Institution on October 1 at 5 o'clock. Lord Rayleigh, the president, will take the chair and short addresses dealing with various aspects of Major Phillips' life and his connexion with the Royal Institution will be given by Sir Robert Robertson, Sir Richard Paget, Mr. R. S. Whipple, Prof. W. V. Mayneord and Sir Henry Dale.

THE Imperial Institute is arranging a series of lectures on recent progress in geological investigation and mineral developments in the Colonies. Each lecture will be devoted to a particular territory and will be given by a recognized authority. The first of the series will be given on October 31 at 3 p.m. by Dr. F. Dixey, director of the Geological Survey of Nigeria, on "Nigeria, Its Geology and Mineral Resources". The second lecture in the series, by Dr. N. R. Junner, director of the Gold Coast Geological Survey, will be given in December, and others will follow.

THE Hertfordshire Institute of Agriculture has unbound copies of *Nature* from 1926 onwards. Those dated up to the beginning of the War are available to bombed-out research institutions and libraries on payment of cost of packing and transport. Further information can be obtained from Mr. H. W. Gardner, Hertfordshire Institute of Agriculture, "Oaklands", St. Albans, Herts.

LETTERS TO THE EDITORS

The Editors do not hold themselves responsible for opinions expressed by their correspondents. No notice is taken of anonymous communications.

Artificial Production of Ergot in the Tropical Plains of Bengal

THE British Ministry of Health in 1941 made an appeal[1] for the cultivation within the Commonwealth of ergot, supplies of which had come hitherto from Central Europe, Spain and Portugal, where it occurs naturally. Wales and certain west coast places in England, and New South Wales, have taken up trial cultivation with a certain degree of success. English results are not definitely known; but the Australian ergot has an "alkaloid content well above the minimum standard provided in B.P., i.e. 0·05 per cent"[2]. In India, the Madras Agricultural Department[3] has taken up its experimental cultivation in the Nilgiri Hills and the produce has a similar alkaloid content.

It now appears that the localities selected both in Madras and New South Wales had a temperate climate and an altitude of a few thousand feet similar to that of its natural habitats. The importance of the present investigation lies in the fact that it is the first record of the artificial production of ergot sclerotia on rye plants under tropical conditions. The experiments were conducted at Calcutta: altitude 18 ft.; the shade temperatures, max. 67°–101° F.; min. 55°–62° F.; with a daily average max. temp. 85·1° F., min. temp. 64·3° F.; a total rainfall of about 13 in. during the period of investigation (from 17.10.44 to 23.3.45), the normal annual rainfall being about 65 in.

Four small plots, manured only with moderate doses of cow-dung, were sown with rye. The plants gave a good stand, and when they flowered they were sprayed by a hand atomizer with a water (sterile distilled) suspension of the conidial spores of the ergot fungus, *C. purpurea*, which was initially obtained by culturing bits of ergot from a commercial source. The sclerotia were first sterilized by steeping for a few seconds in absolute alcohol, then in 0·1 per cent mercuric chloride for five minutes followed by washing in sterile distilled water. Bits of sclerotia were then put in culture media and they gave rise to mycelial growth at 15–25° C., followed by sporulation in Leonian's, Kirchhoff's, rye agar, and wheat agar media.

Plot No.	Sowing date	Flowering date	Spraying date	Total no. of sprayings	Interval between sprays	Harvest date	% of infected tillers
I	17.10.44	24.1.45	31.1.45	6	24 hr.	14.3.45	89
II	30.10.44	2.2.45	7.2.45	6	24 hr.	20.3.45	86
III	15.11.44	4.2.45	8.2.45	8	24 hr.	25.2.45	85
IV	29.12.44	5.2.45	12.2.45	8	24 hr.	3.3.45	81

Spraying was done either in the morning, noon or Afternoon; the noon spraying was preceded by a sterile water spraying one hour earlier, in order to keep the glumes more open to facilitate infection.

Good infection of individual rye flowers occurred on all the plots, being externally evident by secretion of shining drops of light cream-coloured, thick 'honey-dew' drops at the tips of infected spikelets seven to ten days after spraying. This 'honey-dew' stage continued for some weeks. Three to four weeks from the first spraying, small purple sclerotia were found growing out through the glumes, replacing the ovaries. In seven to nine weeks from the first spraying, the sclerotia matured. They were now deep purple to almost black, hard, horny, pseudo-parenchymatous structures emitting a fishy smell. The number of sclerotia varied from 1 to 33 per panicle, 3–6 being the common number; when the number was greater their size was smaller. The biggest sclerotia was 3·6 cm. in length, 0·4 cm. in diameter, and weighed 0·248 gm. when air-dried. The yield obtained is also considered good.

ERGOT SCLEROTIA ON RYE EAR-HEAD.

The sclerotia were then harvested by hand picking and sent after six weeks storage at room temperature (20°–25° C.) in glass bottles for chemical assay to the director of the Bio-Chemical Standardisation Laboratory, Government of India, Calcutta. The results of the analysis reported by him is as follows: "The Ergot Sclerotia were assayed according to the method given in the 6th Addendum to B.P., 1943, and I find that ergots are of good quality, having a total alkaloid content of about 320 mg. per 100 gm. (B.P. figure: not less than 200 mg. per 100 gm.) and the Ergometrine content to be 72 mg. per 100 gm. (B.P. figure: not less than 30 mg. per 100 gm.). It will therefore be seen that these ergots are of a better quality than the B.P. standard Ergot".

Thus very good quality ergot can be easily produced in the plains of the tropics by artificial spraying of rye flowers with the ergot fungus spores, and if taken up commercially India will be in a position to export after meeting her own requirements.

Our thanks are due to Dr. B. Mukherji, director of the Bio-Chemical Standardisation Laboratory, for assaying the alkaloid content of our ergot, and to Prof. J. C. Sen Gupta, head of the Department of Botany, Presidency College, for his continued interest and help. Further, the senior author wishes to thank the Bengal Immunity Co., Ltd., Calcutta, for placing

at his disposal the staff and the finances for this investigation.

J. C. Saha.
S. K. Bhattacharjee.
Researches on Ergot Production,
Botanical Laboratory, Presidency College,
Calcutta. June 7.

[1] *Nature*, **147**, 393 (1941).
[2] Hynes, H. J., *Agric. Gaz. N.S. Wales, Mis. Pub.* No. 3218 (1941).
[3] Thomas, K. M., and Ramkrishnan, T. S., *Madras Agric. J.*, **30**, No. 12 (1942).

B Vitamins in African Fermented Foods

Fermented foods of various kinds constitute a common part of most African diets. Their importance has long been recognized by students of nutrition as a means of relieving the monotony of primitive diets based preponderantly on cereals. The work of Delf[1] and of Fox and Stone[2] has served to establish the antiscorbutic potency of one fermented food, kaffir-beer. During the past two years, we have been engaged in a study of the vitamin B contents of these foods, employing microbiological procedures for the determination of riboflavin[3] and nicotinic acid[4] and fluorimetric methods for thiamin[5] and riboflavin[6].

The foods so far investigated fall roughly into two groups depending on whether the fermentation which they have undergone is non-alcoholic or partly alcoholic. In the former category are the 'soured' foods such as *marewu*, thin soured maize-meal porridge, and similar forms of soured porridge; *leting*, a sour product of maize-meal and kaffir-corn malt fermentation; and *amaas*, soured milk. Kaffir-beer, a thin sweetish-sour gruel with an alcohol content approximately the same as ordinary beer, is the chief example of an alcoholic fermented food. Reference will also be made to 'small beers' and related products which fall into this group.

The average values for vitamin content given below, while they do not indicate the considerable variations which occur, convey some idea of the useful contribution to vitamin intake made by these foodstuffs. The fortuitous mixture of simultaneous lactic, acetic and other fermentations which constitute souring does not greatly affect the vitamin content of cooked cereals. Comparison of *marewu* with the original meal on a dry basis reveals a loss of thiamin of about 30 per cent (largely due to the preliminary boiling) and increases in riboflavin and nicotinic acid of about 40 per cent.

In common with others who have investigated sprouted seeds, we have found malted cereals such as maize, kaffir-corn and various millets to be lower in thiamin but considerably higher in riboflavin and nicotinic acid than the unsprouted grains. Consequently it is advantageous, from a pellagra-preventive point of view, to combine the sprouted with the unsprouted forms. Subsequent souring and straining, as in the preparation of *leting*, leads to an increase in all three B vitamins, particularly in riboflavin.

	Solids (per cent)	Vitamin content (μgm./ml.) Thiamin	Riboflavin	Nicotinic acid
Marewu	9·0	0·19	0·16	2·32
Leting	9·5	0·30	0·34	3·64
Kaffir-beer	8·7	0·47	0·54	4·66
'Second' beer ..	5·0	0·22	0·46	2·81
'Third' beer	3·4	0·23	0·38	1·65
Amaas	12·1	0·40	1·75	1·55

In making *amaas* from milk, only the nicotinic acid content is substantially affected, being reduced to one third. In the winter milks so far studied, the low ascorbic acid, carotene and vitamin A levels are influenced adversely only by the storage necessary for souring.

The preparation of kaffir-beer involves the souring of a meal-malt mixture, as in *leting*; boiling and cooling; addition of extra malt and water; alcoholic fermentation; and straining, which results in the final beer. The values given above were obtained with beers prepared from kaffir-corn and maize meals with kaffir-corn malt. The ingredients vary greatly in different parts of Africa, as also do the details of the basic process. Yet on a dry basis we have found little difference between kaffir-beers brewed by Africans, by municipal breweries and by mine compounds. The yeasts (*Saccharomyces* and *Torulæ*[7]), *Mucor rouxii*[8] and other microflora which play their part in the final alcoholic fermentation bring about a remarkable synthesis of the three B vitamins which we have measured, and probably of the remainder of the B complex. Thus the final beer is not merely an aqueous-alcoholic extract of the vitamins present in the original meal and malt. On a dry basis it now contains roughly twice as much thiamin and nicotinic acid and three times as much riboflavin as the original ingredients.

When the beer has undergone its final straining, a considerable residue remains. In the African home it constitutes an inoculum from which, with the aid of more malt, a series of small beers and other fermented foods can be produced. In this way the synthetic activity of the beer culture is prolonged and the ensuing 'second' and 'third' beers, while lacking the body or flavour of the original beer, are almost equal to it in vitamin content. The watery 'third' beer may be consumed as such by women and children; or it may be used to ferment cooked cereals such as steamed maize bread, to which sugar has been added. Through such by-products of the kaffir-beer brew the nutritive benefit derived by the whole African family is greatly extended. Similar fermented foods arise from the *leting* process, but we have not as yet secured samples of these products.

Previous work in this laboratory[9] has shown that African cereals provide an adequate level of thiamin. It is the remainder of the B complex which must be taken care of in order to achieve vitamin balance. From this point of view, our findings reveal the value of fermented foods as dietary supplements.

In a detailed description to be published elsewhere, full acknowledgment will be made of the assistance afforded us in this investigation. Here we can only express our thanks to the Director of Pathology, South African Medical Corps, who enabled one of us (J. M. T.) to take part in this work.

Leon Golberg.
J. M. Thorp.
Sheila Sussman.
Biochemical Department,
South African Institute for Medical Research,
Johannesburg. June 14.

[1] Delf, E. M., *Pub. S. Afr. Inst. Med. Res.*, **2**, 47 (1921).
[2] Fox, F. W., and Stone, W., *S. Afr. J. Med. Sci.*, **3**, 7 (1938).
[3] Snell, E. E., and Strong, F. M., *Indust. Eng. Chem., Anal. Ed.*, **11**, 346 (1939).
[4] Krehl, W. A., Strong, F. M., and Elvehjem, C. A., *Indust. Eng. Chem., Anal. Ed.*, **15**, 471 (1943).
[5] Golberg, L., and Thorp, J. M., *S. Afr. J. Med. Sci.*, **8**, 129 (1943).
[6] Unpublished modification of the method of Andrews, J. S., *Cereal Chem.*, **20**, 614 (1943).
[7] Crone, W. M., *J. S. Afr. Chem. Inst.*, **24**, 35 (1941).
[8] Doidge, E. M., *Transv. Dept. Agric., Agric. Sci. Bull.*, No. 5, Pretoria (1910).
[9] Golberg, L., and Thorp, J. M., *S. Afr. J. Med. Sci.*, **10**, 1 (1945).

Cultures of *Bacterium brunneum*

In connexion with some fundamental investigations on the removal of wool from sheepskins being carried out by the Council for Scientific and Industrial Research in Melbourne, we have made several endeavours to obtain a culture of *Bacterium brunneum*.

So far, we have been unable to locate a culture in any of the normal repositories such as the National Collection of Type Cultures, the American Type Culture Collection, the Pasteur Institute in Paris and the Bacteriology Department of the University of Pisa, and would like to ask the help of any of the readers of *Nature* who may know of or have a culture of the organism.

According to Bergey's "Manual", the organism was first isolated by Copeland[1] who called it *Bacillus brunneus*. Bergey *et al.* have transferred it to the genus *Flavobacterium* as *Flavobacterium brunneum* Bergey *et al.*

Assistance in this search will be greatly appreciated.

William J. Ellis.
Australian Scientific Research Liaison Office,
Australia House, W.C.2.

[1] Copeland, Rept. Filtration Commission, Pittsburgh, U.S.A., 348 (1899).

Unusual State at Birth of a Bat

During some recent observations on bats in Trinidad, B.W.I., an interesting variation from the normal state of young bats at birth was noticed. A pregnant specimen of *Artibeus planirostris trinitatis* K. And. (Phyllostomidæ) was under observation. Parturition occurred in the afternoon of March 9, 1945, and the young bat was closely examined within two hours and found to have its eyes open. As this seemed unusual, several further specimens of the same species were captured. These were all within a few days of parturition. The fœti were dissected out and examined, and it was found that these also had their eyes open.

This occurrence does not appear to have been recorded before for any family of bats. Dr. G. M. Allen[1], in his book on bats, summarized most of the published work on parturition and post-natal development of bats, but no mention of the above occurrence has been noted. Dr. H. B. Sherman, of the University of Florida, in a private communication, stated he knew of only one other case, which he observed recently occurring in *Tadarida cynocephala* (Molossidæ).

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[1] Allen, G. M., "Bats" (Harvard Univ. Press, 1939).

The Two-body Problem in Milne's Theory of Gravitation

In a recent communication[1], Dr. Camm has answered Schild's contention[2], that Milne's theory of the gravitational interaction of two massive particles in the field of the substratum is not Lorentz invariant and hence either invalid or else dependent on an arbitrary additional principle. Camm has shown that: (1) the consequences of Milne's theory are independent of any particular simultaneity convention, Lorentz-invariant or otherwise; and (2) the choice of such a convention, if Lorentz-invariant, is much more restricted than Schild supposes. While the particular convention, arbitrarily chosen by Schild, is shown to be invalid, Camm gives plausible reasons for adopting the convention,

$$t_1^2 - \mathbf{P}_1^2/c^2 = t_2^2 - \mathbf{P}_2^2/c^2,$$

linking the event $(t_1,\mathbf{P}_1)$ at the particle m_1 with the event $(t_2,\mathbf{P}_2)$ at the particle m_2. A conclusive reason, however, can be given for imposing this condition uniquely, as the following argument shows.

Using the t-scale, according to which the substratum is described as expanding uniformly from a point source, Milne[3] discovered a Lorentz-invariant form for the mutual gravitational potential of two superposed particles, m_1 and m_2, namely,

$$\chi = -\frac{m_1 m_2 c^2 (t_1 t_2 - \mathbf{P}_1.\mathbf{P}_2/c^2)}{M_0\{(t_1 t_2 - \mathbf{P}_1.\mathbf{P}_2/c^2)^2 - (t_1^2 - \mathbf{P}_1^2/c^2)(t_2^2 - \mathbf{P}_2^2/c^2)\}^{1/2}},$$

where M_0 is the 'fictitious mass of the universe'[4], the numerical value of which is taken to be (in the present state of our knowledge) about $2{\cdot}4 \times 10^{55}$ gm. As χ is invariant for each fundamental observer of the quasi-continuous substratum, it follows that

$$\chi = -\frac{m_1 m_2 c^2 t_1}{M_0 |\mathbf{P}_1|},$$

where $(t_1,\mathbf{P}_1)$ are the co-ordinates assigned to an event at m_1 by the fundamental observer with whom m_2 coincides at the (local) epoch t_2; for this observer, of course, $\mathbf{P}_2 = 0$. Hence,

$$\chi = -\frac{m_1 m_2 c^3}{M_0 |\mathbf{P}_1/t_1|} = -\frac{m_1 m_2 c^2}{M_0 |\mathbf{V}_{12}/c|},$$

where $\mathbf{V}_{12}$ is the uniform velocity of relative recession of the fundamental observers with whom m_1 and m_2 are (momentarily) coincident, respectively.

Using the τ-scale, given by the clock-regraduation formula,

$$\tau = t_0 \log(t/t_0) + t_0,$$

it is easy to show[5] that the constant distance apart of m_1 and m_2 is λ_{12}, where

$$\tanh(\lambda_{12}/ct_0) = |\mathbf{V}_{12}/c|.$$

Hence,

$$\chi = -\frac{m_1 m_2 c^2}{M_0 \tanh(\lambda_{12}/ct_0)}.$$

This formula was first given by Milne[6], but the present derivation appears to be more direct.

The outstanding feature of this form of the gravitational potential is its apparent independence of the local epochs, τ_1 (at m_1) and τ_2 (at m_2), and hence of any explicit relation between them.

The characteristic property of the substratum, in τ-time, is the co-existence of a public space and a public time, as in Newtonian physics. In examining any gravitational situation in the latter, it is usual to dissect the history of the system into a continuous set of maps recording 'world-wide' instants. In this way a meaning is given to the idea of conservation, for example, of energy. Similarly, in the gravitational situation considered here, the appropriate 'simultaneity condition' to impose, at least implicitly, is $\tau_2 = \tau_1$. This criterion is chosen freely, but the choice is unique and is not arbitrary. Reverting to t-time, it is easily seen[7] that, if $(t_1,\mathbf{P}_1)$ are the t-scale co-ordinates of the event τ_1 at m_1, and $(t_2,\mathbf{P}_2)$ those of the event τ_2 at m_2,

$$\tau_1 = \tfrac{1}{2}t_0 \log\left(\frac{t_1^2 - \mathbf{P}_1^2/c^2}{t_0^2}\right) + t_0,$$

and similarly for τ_2. Consequently, the relation, $\tau_2 = \tau_1$, tacitly assumed on the τ-scale, implies that, on the t-scale,

$$t_1^2 - \mathbf{P}_1^2/c^2 = t_2^2 - \mathbf{P}_2^2/c^2.$$

This is Camm's condition.

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July 9.

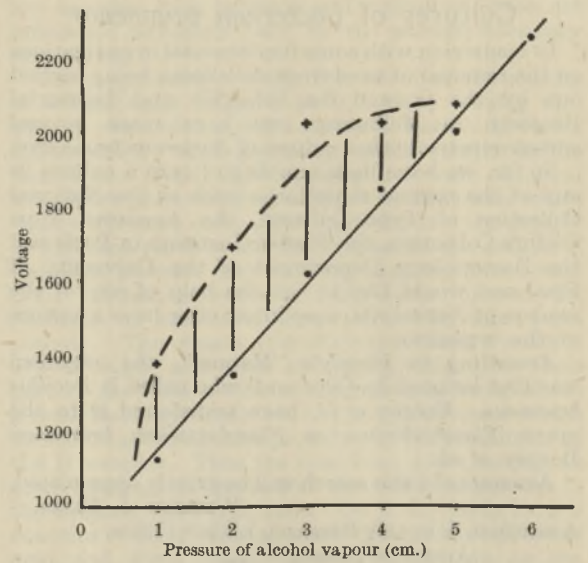
[1] *Nature*, **155**, 754 (1945).
[2] *Phys. Rev.*, **66**, 340 (1944).
[3] *Proc. Roy. Soc.*, A, **160**, 7 (1937).
[4] *Proc. Roy. Soc.*, A, **160**, 4 (1937).
[5] *Proc. Roy. Soc.*, A, **159**, 178 (1937).
[6] *Proc. Roy. Soc.*, A, **160**, 26 (1937).
[7] *Proc. Roy. Soc.*, A, **158**, 344 (1937).

Effect of the Pressure of Alcohol Vapour on the Operation of the Fast Geiger-Müller Counter

As a result of the theoretical researches of Montgomery and Montgomery[1], Stever[2], Korff and Present[3], the operation of the fast Geiger-Müller counter is now very fully understood. In such a counter the discharge produced by a single ionizing particle is quenched by the following three processes: (*a*) The formation of a positive ion sheath which so reduces the field in the neighbourhood of the wire that further ionization by collision cannot take place. (*b*) The prevention of the emission of photo-electrons from the cathode by the rapid absorption of photons by the polyatomic vapour followed by the predissociation of the organic molecule. Processes (*a*) and (*b*) are of especial importance in the quenching of the initial discharge. (*c*) The prevention of the secondary emission of electrons from the cathode by positive ion bombardment by the predissociation of the organic molecule. Korff and Present have shown that the stopping of multiple discharges is due to process (*c*).

The role of the polyatomic vapour in the Geiger-Müller counter suggests that increasing the pressure of the vapour should improve the performance of the counter, since the efficiency of each quenching process would seem to be increased by increasing the quantity of vapour. A search through the literature showed that the references to the effect of the pressure of polyatomic vapour on the performance of the counter are very scanty. Only three observations[4,5,6] have been made, and the general trend of the results is to show that the efficiency of the quenching processes first increases and then decreases with increase in the pressure of the polyatomic vapour.

We have investigated this point by studying the variation in the length of the plateau of a Geiger-Müller counter of McCusker's design[7] with alcohol pressure for different pressures of argon. In order to avoid the possibility of the contamination of the cathode surface by the condensation of alcohol, all tests have been made at a temperature of 40° C. where the saturated vapour pressure of alcohol is 13 cm. mercury. The results, given in the accompanying table, show the effect of alcohol pressure on the starting potential and on the length of the plateau. The results for alcohol alone are plotted in the graph, the full line indicating the variation of starting potential and the broken line the onset of multiple discharges. The shaded portion is the region in which the counter is normally used to record ionizing particles.



STARTING POTENTIAL (FULL LINE) AND ONSET OF MULTIPLE DISCHARGE (BROKEN LINE) PLOTTED AGAINST PRESSURE OF ALCOHOL. DIFFERENCES IN THE ORDINATES OF THE TWO CURVES REPRESENT PLATEAU-LENGTHS.

Two points emerge from the results: (1) the alcohol counter can be used only in a narrow range of alcohol pressures; and (2) the 'useful' pressure range is not affected to a great extent by the argon pressures used in this experiment; in fact, the argon acts merely as a 'filler' gas to increase the efficiency of the counter[5].

The graph brings out clearly that the variation in plateau-length is due to the difference in the variation of starting potential and of the production of multiple discharges. The variation of starting potential is seen to be almost linear, as might have been expected (Trost[4]).

Total pressure alcohol + argon (cm.)	Alcohol pressure (cm.)	Starting potential (volts)	Length of plateau (volts)
1	1	1130	250
2	2	1350	340
3	3	1620	400
4	4	1850	170
5	5	2000	70
6	6	2250	0
16	0		0
	0·5	1350	210
	2	1670	370
	2·5	1710	400
	3	1780	400
	4	2050	250
	5	2250	190
	6	2350	0
30	0		0
	2	2060	310
	3	2130	320
	4	2220	210
	4·5	2380	100
	6	2460	0

The curve showing the onset of multiple discharges as a function of pressure is determined by the efficiency of the quenching processes in preventing the rapid multiplication of electrons. Since this curve has the form shown, it is clear that the plateau will disappear as soon as the curve intersects the starting potential line. We would suggest that the decrease in the plateau is due to the failure of the quenching of secondary emission from the cathode by positive ion bombardment. The increase in

starting potential causes the velocity of the positive ions to become so great that eventually there is a liberal emission of electrons from the cathode even at the starting potential.

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[1] Montgomery, C. G., and Montgomery, D. D., *Phys. Rev.*, **57**, 1030 (1940).
[2] Stever, H. G., *Phys. Rev.*, **61**, 38 (1942).
[3] Korff, S. A., and Present, R. D., *Phys. Rev.*, **65**, 274 (1944).
[4] Trost, A., *Z. Phys.*, **105**, 399 (1937).
[5] Weisz, P., *Phys. Rev.*, **62**, 477 (1942).
[6] Rochester, G. D., and Jánossy, L., *Phys. Rev.*, **63**, 52 (1943).
[7] McCusker, C. B. A., *J. Sci. Instr.*, **21**, 120 (1944).

Flow of Water Through Very Narrow Channels and Attempts to Measure Thermomechanical Effects in Water

We have recently experienced instances where, particularly under humid tropical conditions, evacuated and sealed-off apparatus has shown marked deterioration due to the appearance of water vapour inside the evacuated space. While the presence of water vapour can be easily and definitely established, it appears that the channels which allow this transference of water are impervious to air. This means that although the apparatus is, within the limits of our measurements, completely airtight, it nevertheless allows measurable amounts of water vapour to pass into the vacuum.

Considering it possible that this indicated the existence of some unusual properties of flow of water through exceedingly narrow channels (as occurs in the case of liquid helium[1]), we carried out some experiments on the flow of water through channels of the order of 10^{-5} cm. in width. Fig. 1 shows the simple apparatus used; at the centre of a horizontal capillary tube about 10 cm. long, a 'porous plug' of tightly tamped jewellers' rouge was arranged, with a continuous water column extending *through*, and on each side of, the plug. Pressures both above and below atmospheric could be applied at P.

By observing the rouge particles under a high-power microscope, the average particle size was reckoned to be about 10^{-4} cm., and the average width of channel between the particles was about $1{\cdot}5 \times 10^{-5}$ cm. By observing the rate of flow of dry air through the plug *before* the introduction of the water column, and using the known value for the viscosity of air, we were able to obtain a reasonable check on both the number of channels through the plug and their average width. These figures were afterwards used to obtain a value for the viscosity of water when flowing through the porous plug.

Fig. 2 shows typical results for flow of water through several different porous plugs. The flow was purely laminar ($d \log V/d \log P \doteqdot 1$), even up to pressures of 3 atmospheres; but the actual value of viscosity appeared to be some five to ten times larger than for flow through smooth capillaries. In view of the uncertainty in the channel width, this is probably within the limits of error of our measurements; but there is clearly no evidence of anything in the nature of 'superfluidity'. Flow was observed through plugs of various materials (for example, rouge, French chalk, fine carborundum) and all gave practically identical results.

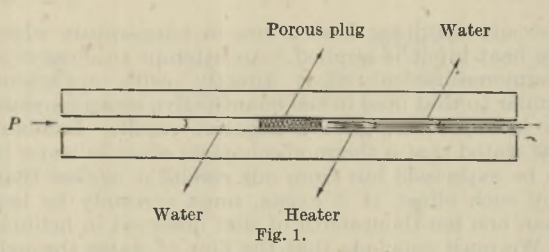

Fig. 1.

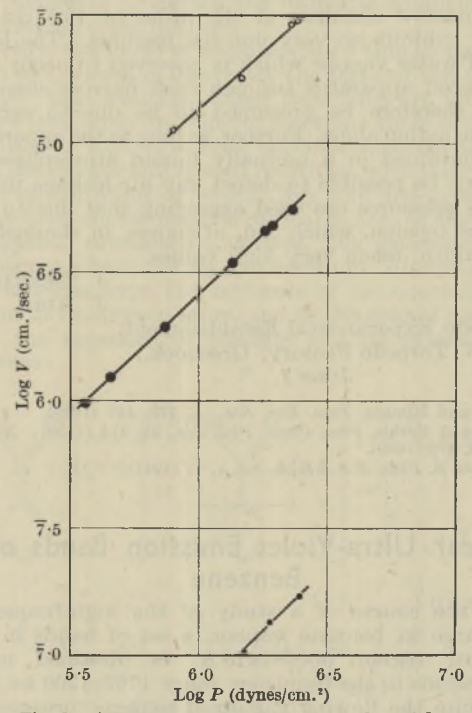

Fig. 2. Average channel width: o, 2×10^{-5} cm.; ●, $1{\cdot}5 \times 10^{-5}$ cm.; •, $0{\cdot}7 \times 10^{-5}$ cm.

Thus the flow of water through channels of this width appears to follow the usual hydrodynamic laws; but, after the water had been forced clear of one side of the plug, it was then found impossible to drive any air through the plug, even with pressures up to 3 atmospheres applied at P. Water could, however, continue to be drawn backwards or forwards through the plug. Even when the water was totally removed from the capillary, the plug still remained vacuum tight, the flow of air being at any rate less than one ten-thousandth that observed when the plug was dry.

The possibility of the existence of a 'thermomechanical effect' in water (as occurs in liquid helium[2]) was also investigated, by inserting a heater on one side of the plug as shown in Fig. 1, and noting whether the rate of flow was altered when a heat input was applied. Although distinct changes in the rate of flow of the water were observed for quite small heat inputs (up to ½ watt), it was clear that these changes were not to be associated with a thermomechanical effect. Two reasons lead us to this conclusion, namely, the facts that the rate of flow was *increased* whether the excess pressure P was above or below atmospheric, and that when P was zero no flow could be detected. The change in rate of flow is almost certainly due merely to the decrease in

viscosity resulting from a rise in temperature when the heat input is applied. An attempt to observe a thermomechanical effect directly, with apparatus similar to that used in the quantitative measurements on helium[2], also gave a negative result. Landau[3] has stated that a thermomechanical effect in water is to be expected; but from our results it is clear that any such effect, if it exists, must certainly be less than one ten-thousandth of that observed in helium.

We must conclude that the flow of water through very narrow channels of the order of 10^{-5} cm. in width exhibits no very unusual features. The leakage of water vapour which is observed to occur into evacuated apparatus through such narrow channels must therefore be presumed to be due to surface tension action alone. Further, so long as the apparatus is maintained in a normally humid atmosphere, it will not be possible to detect any air leakage unless excess pressures are used exceeding that due to the surface tension, which can, of course, in channels of this width, reach very high values.

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[1] Allen and Misener, *Proc. Roy. Soc.*, **A**, **172**, 467 (1939).
[2] Allen and Reekie, *Proc. Camb. Phil. Soc.*, **35**, 114 (1939); *Nature*, **144**, 475 (1939).
[3] Landau, *J. Phys. U.S.S.R.*, **5**, No. 1, 71 (1941).

Near Ultra-Violet Emission Bands of Benzene

In the course of a study of the high-frequency discharge in benzene vapour, a set of bands in the spectral region 3000–2475 A. is obtained using oscillations in the frequency range 1765–1200 kc./sec. to excite the flowing vapour of benzene (pressure ~ 0·1 mm. mercury). These oscillations were produced in a modified Hartley circuit using a Mullard *PM4DX* valve. A Hilger medium quartz spectrograph was used as the resolving instrument to photograph the spectrum. The bands, which are degraded towards longer wave-lengths, occur in several distinct groups, six such being obtained in the present experiments. Measurements of the wave-lengths of the band heads show that they are identical with the bands obtained in the Tesla discharge in benzene vapour[1,2].

It has been possible to analyse most of the bands observed into five series designated as *A*, *B*, *C*, *D* and *F*, in all comprising about 76 band heads, in accordance with the nomenclature adopted by Sponer *et al.*[3], in their analysis of the near ultra-violet absorption bands of benzene. It may be recalled that these absorption bands of benzene are, according to Sklar[4], due to the forbidden electronic transition $^1A_{1g} \rightarrow {}^1B_{2u}$ which can only be made possible in the presence of a superposed non-totally symmetrical vibration of the type ε_g^+. In agreement with this deduction, all of these five series in emission, except the *F* series, involve the (606 cm.$^{-1}$) ε_g^+ vibration, either in the final state or in the initial state where its frequency falls down to 520 cm.$^{-1}$ exactly as in absorption or fluorescence spectra. The present data on the *F* series, however, are better represented if a frequency of 1610 cm.$^{-1}$ instead of 1596 cm.$^{-1}$ is assumed for the second ε_g^+ vibration which is also present in the ground state. The average discrepancy between observed and calculated values is 5 cm.$^{-1}$, which is equivalent to about 0·4 A. in this region and is within the limits of experimental error. About twenty band heads the intensity of which is low do not afford unambiguous classification. They fit in fairly well as members of one or other of the above series, involving frequencies both in the excited and the ground states; but it is also possible that they may involve some other new series altogether.

Whereas in absorption the positive members of the various series, that is, those involving frequencies of the excited state, are naturally predominant, in high-pressure fluorescence it is the negative members involving vibration frequencies of the ground state which form the bulk of the spectrum. Indeed, a rearrangement of the data of Ingold and Wilson[5] on the fluorescence spectrum of benzene clearly shows this expected difference between absorption and high-pressure fluorescence. The emission spectrum, which ought to contain both types of members of the series and hence present a much more complicated structure is, however, surprisingly simple. This is due to the circumstance that although both negative and positive members of the series are present, they are not loaded with more than 3 or 4 quanta of 160 cm.$^{-1}$, which is the difference between $(\alpha^1{}_{2g})''$ (400) and $(\alpha^1{}_{2g})'$ (240) non-totally symmetrical frequency. In contrast to this, it may be noted that most of the series observed in fluorescence are loaded with high quanta (in some cases up to 26) of this difference frequency.

The intensity distribution in each series of bands is roughly the same as that observed in the fluorescence spectrum, namely, an almost regular decrease with increasing quantum numbers of vibration in each series. The intensity of the various series is, however, in the following order: *B*, *F*, *D*, *A* and *C*. This may be contrasted with the intensity of the fluorescence series, which from the data of Ingold and Wilson gives the following order: *C*, *A*, *B*, *E* and *D*.

This analysis shows that the bands observed are, as in fluorescence, to be attributed to the electronic transition $^1B_{2u} \rightarrow {}^1A_{1g}$ in the benzene molecule.

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May 5.

[1] McVicker, Marsh and Stewart, *Phil. Mag.*, **48**, 628 (1924).
[2] Austin and Black, *Phys. Rev.*, **35**, 452 (1930).
[3] Sponer, Nordheim, Sklar and Teller, *J. Chem. Phys.*, **7**, 207 (1939).
[4] Sklar, *J. Chem. Phys.*, **5**, 669 (1937).
[5] Ingold and Wilson, *J. Chem. Soc.*, 941 (1936).

The 'Green Flash' at Sunset with a Near Horizon

The observation of the 'green flash' with a near horizon, presumably at Harrow, recorded by Mr. D. R. Barber in *Nature* of August 4, p. 146, recalls one of which I gave an account in the *Meteorological Magazine* of October 1926. In this case the artificial 'horizon' was a building some miles off, and the colour of the flash was "a smoky white with a faint tinge of green". Mr. Barber also comments on the small saturation of the colours which he observed; it is possible that this is due, not to the nearness of the 'horizon', but to the smoky atmosphere of London.

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OXIDATION AND REDUCTION IN CHEMISTRY

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THE conjunction in *Nature* of July 14 of the article by Dr. D. H. Hey entitled "The New Organic Chemistry" with the correspondence on olefinic-α-halogenation prompts me to offer some comments and an intimation of various relevant results recently obtained in my laboratory.

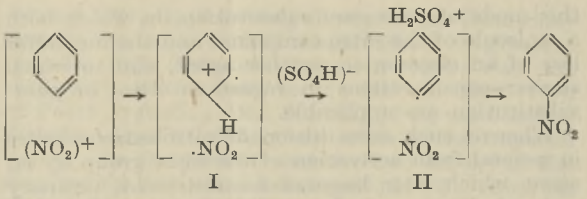
The conclusion from Gomberg and Bachmann's results that "the laws of aromatic substitution did not hold", and the view that "free radicals were involved" in these and the various reactions studied by Hey and Waters are not warranted by the facts. The absence of *meta*-derivatives from the products of reaction is clearly indicative of some regularity of the substitution process and we therefore seek correlation with recognized processes. This reveals an apparently paradoxical correspondence with what has been termed cationoid substitution of benzene and its homologues on one hand, and with what is usually called anionoid substitution of nitrobenzene on the other. Further, however, the same applies to mercuration[1], and there is also agreement between the results of mercuration[2], and of coupling in presence of cupric salts[3], in the case of α-β-unsaturated esters and carbonyl compounds. We are thus confronted with two concordant instances of a paradox, which must be resolved instead of being merely relegated to a "New Organic Chemistry".

It has for some considerable time appeared to me to be a capital defect of the usual presentations of organic reactivity that, with so much that is cogent, there is insufficient expression, and so, frequently, insufficient realization, of the essential community of all chemical reactions. Considerations of history, simplicity and ultimate value all suggest that this expression should be, as, indeed, physical chemists have recognized, in terms of oxidation and reduction. It is for this reason that work in my laboratory has for some time been directed to the relationship between processes of substitution and those of oxidation[4]. This matter is, for example, only introduced towards the end of Ingold's monograph on "Organic Reactions"[5], and receives no specific attention in an exposition by Sir Robert Robinson[6]. Although, in his most recent discussion[7], an earlier suggestion by Jacobson[8] provoked attention to the matter, this did not suffice to obviate a conclusion endorsing the views of Hey and his associates. Indeed the currency which they have so long enjoyed is a testimony to the reality of the defect to which I point.

For these reasons, I prefer, even at the risk of some apparent retrogression[9], to adopt a device of approximation, representing organic reactions as a sequence of steps, involving the full electron transfer of oxidation and reduction processes, in which, however, the reactants remain "within the sphere of each other's action"[10], and to indicate this by the bracket notation conventional for such purposes among organic chemists.

On this basis I formulate the nitration of benzene as follows:

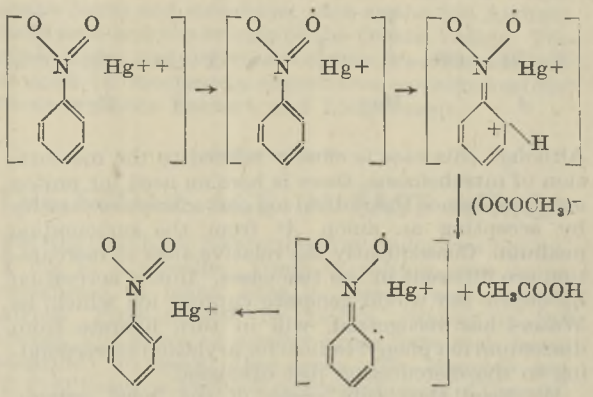
The initial change involves transference of a π-electron, while the transition from (I) to (II) by loss of a proton to the surrounding medium by means of the hydrogen bond mechanism is determined by



I II

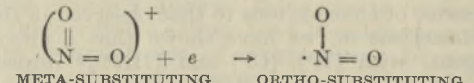
the tendency to restore the aromatic condition and neutrality of the nucleus.

While the mode of application of this to mercuration is obvious, it illustrates the force of the suggestion[11] "that radicals, rather than ions, are produced more frequently in organic reactions than is usually realized". Also, it at once becomes apparent that, in the Bamberger and related reactions, with the systematic exploitation of which Hey and his co-workers have been concerned, the radical is not, as they have supposed, pre-existent or free, but generated as a transient phase during the reaction. Abstraction of an electron from the molecule of nitrobenzene will occur at an oxygen atom, and in the case of mercuric ion the sequence of changes can be expressed as follows:



The limitation of mercuration to the *ortho*-position is presumably due to retention of the mercurous ion (negatively charged by comparison with the mercuric state) in close proximity in the transition complex to the nitro group. A neutral phenyl radical has more freedom, so that *para*-arylation ensues.

Considerations of space preclude treatment here of the various issues arising from this discussion of the Bamberger and related reactions; but some perspective view of the matter is desirable at this point. Thus, since this hitherto unrecognized mode of *ortho-para* substitution arises from the variable degree of oxidation of the substituting agent, it should occur in other instances of this type. Accordingly, the ordinary *meta*-directed nitrations are accompanied by formation of notable amounts of *ortho*-derivative:



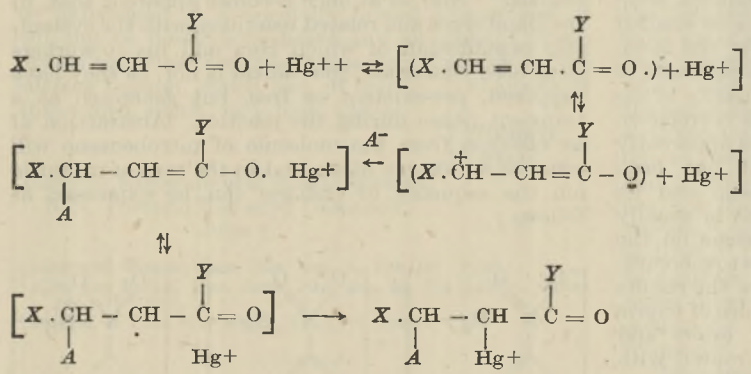
META-SUBSTITUTING ORTHO-SUBSTITUTING

and to a greater extent with greater ease of surrender of an electron by the directive group. Similarly, as much as thirty per cent of *para*-disulphonation of benzene occurs at 183°[12].

The reaction of nitro-compounds with hydroxyl[13], cyanide[14], or fluorenyl[15] ions represents a variant of

this mode of *ortho-para* substitution, in which both a molecule of the nitro-compound and the ion suffer loss of an electron to another agent, and to which similar considerations in regard to *ortho-* or *para-*substitution are applicable.

Whereas such substitution of nitrobenzene arises in general from activation of the nitro group by an agent which later becomes a substituent, ordinary *meta*-substitution, so far as it is due to activation[9], depends on that of an external agent, for example, by hydrogen bond formation. *Meta*-substitution is thus related to α-activation of carbonyl compounds by acids. If, however, an αβ-unsaturated carbonyl derivative be activated by mercuric ion, we have the following changes:



Although this case is closely related to the mercuration of nitrobenzene, there is here no need for proton extrusion, since the radical ion can achieve neutrality by accepting an anion A^- from the surrounding medium. Consequently the relative sites of mercuration are different in the two cases. Initial activation by cupric ion would generate cuprous ion which, as Waters has recognized, will in turn liberate from diazonium ion phenyl radical for arylation corresponding to the mercuration just discussed.

We need thus only speak of the 'new' organic chemistry in the sense that we enlarge the present relatively limited outlook to one exhibiting more explicit recognition of the relation of chemical reaction to processes of oxidation and reduction. Indeed, the formulation of chemistry in general needs a similar revision. Thus, we have as examples from inorganic chemistry related to those above, the substitutive mercuration of ammonia in the formation of Nessler's reagent, and the colour of those metallic compounds which do not contain coloured cations. The colour of mercuric oxide, for example, is presumably due to a relationship in its lattice which we may represent

$$Hg\cdot\cdot O'' \rightleftharpoons Hg\cdot O'.$$

A kinetic study of the nitrosation of dimethylaniline, carried out in conjunction with Dr. G. Baddeley and Mr. D. M. Lever, having revealed a similar accelerative influence of chloride ions to that observed in the case of diazotization, we have shown that a nitrosating reagent, with [H·], [Cl′] and [HNO_2] respectively 0·2, 1·9 and 0·1 molar, slowly dissolves metallic gold at the ordinary temperature, while solutions of benzene, ethyl benzene and tetralin in glacial acetic acid saturated with hydrogen chloride and containing a molar concentration of nitrous acid at 25° furnish small yields of chlorobenzene, 4-chloroethylbenzene and a mixture of *ac-* and *ar*-chloro-derivatives respectively. In other words, we have in the reagent

$$HNO_2 + H^{\cdot} + Cl' \rightleftharpoons H_2O + NO + Cl,$$

corresponding to the familiar reaction with iodide ion, and the acceleration noted above is due to atomic chlorine or to nitrosyl chloride, according as one regards the latter[11].

A kinetic study with Dr. G. Baddeley has shown that the rate of formation of 4 : 4′-diethoxy-1 : 1′-dinaphthyl from α-ethoxynaphthalene in presence of nitrobenzene and aluminium chloride is proportional to the concentration of the ethoxy-derivative. It thus involves the corresponding radical[11]. It is illustrative of the theme developed at the outset of this note that the course of the reaction is essentially that of benzene substitution as formulated above.

It seems to have been overlooked that olefinic α-oxidation was established so far back as 1894 when Wagner demonstrated the structure of sobrerol.

Studying the use of tertiary butyl-hypochlorite as a chlorinating agent, Dr. R. F. Garwood and I have shown it to (*a*) attack carbonyl compounds instantly, especially in presence of a trace of aluminium chloride, boron trifluoride, etc., forming, for example, mono- and di-chloroethyl malonates from ethyl malonate; (*b*) furnish a 65 per cent yield of Δ^2 *cyclo-hexenyl* chloride from cyclohexene under Ziegler's chlorination conditions. Also, independently following this up, Dr. Garwood has demonstrated the efficiency of this reagent in presence of benzoyl peroxide in chlorinating toluene, ethyl benzene, *p*-bromotoluene and *cyclo*-hexane to benzyl chloride, α-phenylethyl chloride, *para*-bromobenzyl chloride, and *cyclo*hexyl chloride respectively. Further, in contrast to the experience of Kharasch and Brown, using sulphuryl chloride and benzoyl peroxide, even *para*-nitrotoluene furnished some *para*-nitrobenzyl chloride.

It is obvious that fuller treatment of these various matters is required, and it is hoped to provide these in due course.

[1] Dimroth, *Ber.*, **35**, 2036 (1912).
[2] Billmann, *Ber.*, **43**, 568 (1910); Schrauth and others, *ibid.*, 695; **44**, 1048, 1432 (1911).
[3] Meerwein, Buchner and Emster, *J. prakt. Chem.*, **152**, 237 (1939).
[4] Compare Garwood and Kenner, *J. Soc. Chem. Ind.*, **62**, 166 (1943).
[5] *Chem. Rev.*, **15**, 225 (1934).
[6] Institute of Chemistry (London, 1932).
[7] *J. Chem. Soc.*, 220 (1941).
[8] *Ann.*, **428**, 76.
[9] Compare Hughes and Ingold, *J. Chem. Soc.*, 608 (1941).
[10] Jones and Kenner, *J. Chem. Soc.*, 1848 (1931); 711 (1932).
[11] Kenner, *Chem. and Ind.*, 469 (1933).
[12] Compare Hollemann, "Direkte Einfuhrung von Substituenten in den Benzolkern" (Leipzig, 1920), 199.
[13] Wohl, *Ber.*, **32**, 3468 (1899).
[14] Compare Lobry de Bruyn, *Rec. trav. chim.*, **23**, 39 (1901).
[15] Montmollin, *Helv. Chim. Acta*, **6**, 94 (1923).

GAS RESEARCH BOARD

THE Gas Research Board—now responsible for the research activities of the British gas industry—has issued its fifth annual report (Gas Research Board, 1 Grosvenor Place, London, S.W.1), covering the session ending June 30, 1944. With the end of hostilities in Europe it has become possible to disclose some of the war-time activities.

Work on the gasification of coal in hydrogen under pressure had, by that time, passed from the laboratory

into the works as a result of the installation of a small plant in the Bournemouth gasworks. In the initial stages a semi-coke, heated to 600° C., was treated with hydrogen under 50 atmospheres pressure. Under these conditions, gasification partly by liberation of volatile matter and partly by reaction of hydrogen with carbon takes place with great rapidity, for the formation of methane is an exothermic reaction. Another approach to the production of methane from coal is the synthesis from mixtures of carbon monoxide and hydrogen. Synthesis of liquid hydrocarbons is better known, but by choice of catalyst and conditions methane can also be obtained. The most important of the conditions is the almost complete removal of organic sulphur from the gas by processes which require very stable catalysts. Results of high promise have been obtained and suggest that fuel gas may soon be distributed almost free from sulphur.

All this work aims at the preparation of a fuel gas without the limitation of starting from high-class coking coal, rather indeed from any coal. This achievement will almost certainly be accompanied by the production of gas from sulphur.

In recent years it has been recognized that although heat is transferred by convection and radiation, the differentiation of the two may be important. In certain operations, especially those involving drying, radiation may prove more effective than convection. Effectiveness may be influenced by the quality not only of the source of radiation but also by that of the surface receiving the radiation. The report shows that the Gas Research Board is actively engaged in this field because gas-heated surfaces are specially effective for radiant heating, and this promises great industrial application.

Another branch of the Board's activities involves the separation by refrigeration of coal gas into its constituent gases, whereby advantage can be gained from the special properties of each.

The report shows that the Board, in spite of war-time difficulties, is making rapid progress in the development of new techniques for the manufacture and use of gaseous fuel.

FREQUENCY OF EARTHQUAKES IN CALIFORNIA

ACCORDING to Gutenberg and Richter, the southern California area, including the Owens Valley, has about one half of one per cent of the seismic activity of the globe ("Frequency of Earthquakes in California." By B. Gutenberg and C. F. Richter. *Bull. Seis. Soc. Amer.*, **34**, No. 4, 185 ; 1944). This conclusion is arrived at by considering statistically up-to-date information concerning earthquakes, employing the instrumental magnitude scale.

The magnitude M of an earthquake was originally defined as proportional to the logarithm of the maximum trace amplitude on the seismogram of a standard torsion seismometer distant 100 km. from the epicentre, and having a normal shallow depth. The magnitude scale is chosen to make $M = 0$ correspond to the smallest instrumentally recorded shocks. It is found that $M = 2$ corresponds to the smallest shocks ordinarily reported felt, $M = 4{\cdot}5$ causes slight damage, $M = 6$ earthquakes are moderately destructive, and $M = 8{\cdot}5$ corresponds to the largest recorded shocks.

Since 1921, the following shocks in the California–Nevada region have had magnitude 7 or greater : Jan. 31, 1922 (7·3), off the north coast ; Jan. 22, 1923 (7·1), off the north coast ; Nov. 4, 1927 (7·0), off Point Arguello ; Dec. 20, 1932 (7·3), west-central Nevada ; Dec. 31, 1934 (7·0), south of the Imperial Valley. In the present century, two shocks in the same region have exceeded magnitude 7·5 : April 18, 1906 (8·25), central California ; Oct. 2, 1915 (7·75), north-central Nevada.

This gives the California–Nevada region about 90 per cent of the seismic activity of the United States.

According to the authors, the expected occurrence of about four great earthquakes per century in the California region by no means excludes the possibility that double that number might occur in a given century, or that a whole century might pass without even one. Further, the events are not strictly independent. A great shock, such as that of 1906, represents a regional release of strain ; after the immediate aftershocks have subsided, it may be expected to be followed by a period of abnormal quiet, as is probably now the condition in central California. It is worth noting that great shocks are to be looked for only in association with the major active faults and structures, such as the San Andreas fault zone and the trough of the Owens Valley. The other faults and active structures are characterized at most by moderately destructive earthquakes like those at Santa Barbara and Long Beach.

THE STONE AGE IN EAST AFRICA

IMMEDIATELY before the War, industries belonging to a so-called Tumbian culture were being recognized at many sites in eastern and western Africa. First noticed by Dr. X. Stainer in the Congo, industries of similar types were soon being identified in many other areas. Dr. Menghin and T. P. O'Brien (in his book on the prehistory of Uganda) went so far as to suggest that the Tumbian culture was derived directly from that of the *coups de poing* makers, that it could be described as a sort of Acheulean gone to seed. Prof. H. Breuil, however, in a recent study of Dr. Cabu's finds, denies the existence of the Tumbian as a distinct culture, and he and Prof. van Riet Lowe suggest that the industries represent only a variation of the Sangoan culture of Uganda with strong Fauresmith affinities (*Trans. Roy. Soc. of South Africa*, **30**, pt. ii ; 1944).

Dr. Leakey and Archdeacon Owen have now entered the ring, and in the first Occasional Paper of the Coryndon Memorial Museum, entitled "A Contribution to the Study of the Tumbian Culture in East Africa", they unequivocally uphold its status as a culture. Owen and Leakey's publication deals mainly with a series of sites, chiefly from the Kavirondo area, where industries belonging to various stages of this debatable culture have been discovered. There are several pages of illustrations. In conclusion, there is a general discussion on certain aspects of the Stone Age in Kenya, followed by an appendix, where Breuil and Lowe's work, quoted above, is cited, and the conclusions there set out denied.

As a personal opinion I can only add that every so-called Tumbian assemblage of implements which I have seen has appeared to contain several elements and to have been a mixture of the relics of more than

one culture. Certain types do certainly seem to be derived from a *coup-de-poing* prototype. There is no reason to deny the possibility of a late survival of the early palæolithic cultures in parts of Africa where the sharp division lines resulting from the several glacial maxima are absent. That a part of the so-called Tumbian is, as the authors claim, something new to us and derivative from the Acheulean would seem to be quite possible; but that the industries discussed contain elements from other cultures and that therefore a pure Tumbian industry has yet to be isolated is also more than likely.

M. C. Burkitt.

FORTHCOMING EVENTS

Saturday, September 22

British Psychological Society (at Tavistock House, Tavistock Square, London, W.C.1), at 2.30 p.m.—Mr. E. G. Chambers: "Statistical Psychology, a Plea for Scientific Method"; Mr. Ranyard West: "The Contribution of Psychology to Politics".

Monday, September 24

Association of Austrian Engineers, Chemists and Scientific Workers in Great Britain (at the Austrian Centre, Swiss Cottage, 69 Greencroft Gardens, London, N.W.6), at 7.30 p.m.—Dr. M. D. H. Strauss: "The Physical Basis of the Atom Bomb."

Tuesday, September 25

Royal Photographic Society, Scientific and Technical Group (at 16 Prince's Gate, London, S.W.7), at 6 p.m.—Dr. G. B. Harrison: "How it Works in Photography", No. 1: "The 'Light and Shade' of Image Formation".

Quekett Microscopical Club (at the Royal Society, Burlington House, Piccadilly, London, W.1), at 7 p.m.—Conversation and the Exhibition of Specimens.

Thursday, September 27—Friday, September 28

Faraday Society (at University College, Gower Street, London, W.C.1).—General Discussion on "Oxidation".
Thursday, September 27, at 11 a.m.
Friday, September 28, at 10.30 a.m.

Friday, September 28

Biochemical Society (in the Human Nutrition Research Unit of the Medical Research Council, National Hospital for Diseases of the Nervous System, Queen Square, London, W.C.1), at 11 a.m.—Scientific Papers and Demonstrations.

Physical Society, Optical Group (Department of Physics, Imperial College, London, S.W.7), at 3.15 p.m.—Mr. E. Wilfred Taylor: "Evolution of the Dividing Engine"; at 5 p.m.—a film entitled "Motion-picture Records of the Whole Sky" will be shown.

Institute of Welding, East Scotland Branch (at the Heriot-Watt College, Chambers Street, Edinburgh), at 7.30 p.m.—Mr. A. Stephenson and Mr. D. Llewellyn: "Welding: Past, Present and Future".

APPOINTMENTS VACANT

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

Agricultural Assistant Education Officer—The Chief Education Officer, County Education Office, Stracey Road, Norwich, endorsed 'Agricultural Assistant Education Officer' (September 29).

Senior Engineering Assistant—The Surveyor, Hebburn Urban District Council Offices, Argyle Street, Hebburn (September 29).

Laboratory Technician—The Medical Superintendent, Birmingham Mental Hospital, Winson Green, Birmingham (October 1).

Chair of Chemical Engineering tenable at the Imperial College of Science and Technology—The Academic Registrar, University of London, Richmond College, Richmond, Surrey (October 3).

Engineers (temporary staff) by the Government of Nigeria for the Public Works Department—The Ministry of Labour and National Service, Appointments Department, Technical and Scientific Register, Room 670, York House, Kingsway, London, W.C.2, quoting E.1899.A (October 5).

Lecturer in Engineering Subjects in the Royal Aircraft Establishment Technical School, Farnborough, Hants.—The Ministry of Labour and National Service, Appointments Department, Technical and Scientific Register, Room 670, York House, Kingsway, London, W.C.2, quoting C.2641.A (October 5).

Superintendent (with qualifications in chemical technology and chemical engineering research applied to explosives) in a Government Research Establishment—The Ministry of Labour and National Service, Appointments Department, Technical and Scientific Register, Room 670, York House, Kingsway, London, W.C.2, quoting F.3886.A (October 5).

Geologist by the Government of Iraq—The Ministry of Labour and National Service, A.9, Technical and Scientific Register, Room 670, York House, Kingsway, London, W.C.2, quoting F.4826.A (October 5).

Physicists (2) for a Petroleum Research Station near London—The Ministry of Labour and National Service, Appointments Department, Technical and Scientific Register, Room 670, York House, Kingsway, London, W.C.2, quoting A.1023/4.XA (October 6).

Lecturer in Chemical Engineering in the Department of Oil Engineering and Refining—The Secretary, The University, Edmund Street, Birmingham 3 (October 8).

Technical Assistant (Chemist) in the Sewage Disposal Department—The Town Clerk, Guildhall, Nottingham (October 15).

Assistant Lecturer and Demonstrator in Botany—The Secretary, West of Scotland Agricultural College, 6 Blythswood Square, Glasgow, C.2 (October 21).

Third Lecturer in Bacteriology and Assistant Bacteriologist in the Public Health Laboratory—The Secretary, The University, Birmingham, 3 (October 31).

Readership in Public Health tenable at the London School of Hygiene and Tropical Medicine—The Academic Registrar, University of London, Richmond College, Richmond, Surrey (January 1).

Senior Science Master in the King Edward VII School—The Director of Education, Education Office, Leopold Street, Sheffield, 1.

University Assistant in the Department of Natural History in the United College, St. Andrews—The Secretary, The University, St. Andrews.

Laboratory Assistant in the Division of Histology—The Bursar, Royal Veterinary College, Camden Town, London, N.W.1.

Technical Advisory Officer—The Executive Officer, Shropshire War Agricultural Executive Committee, County Buildings, Shrewsbury.

REPORTS and other PUBLICATIONS

(not included in the monthly Books Supplement)

Great Britain and Ireland

Colonial Research, 1944–45. 1. Colonial Research Committee, Second Annual Report; 2. Colonial Products Research Council, Second Annual Report; 3. Colonial Social Science Research Council, First Annual Report. (Cmd. 6663.) Pp. 32. (London: H.M. Stationery Office, 1945.) 6*d*. net. [238

The British Radio Industry in War and Peace. Pp. ii+26. (London: Radio Industry Council, 1945.) [238

British Electrical and Allied Industries Research Association. Technical Report (Reference Y: T6): Capacity Current Heating—Résumé of Published Information. By T. H. Messenger and D. V. Onslow. Pp. 20+2 plates. (London: British Electrical and Allied Industries Research Association, 1945.) 9*s*. [238

Imperial Bureau of Horticulture and Plantation Crops. Technical Communication No. 16: Further Work on Plant Injection for Diagnostic and Curative Purposes. By W. A. Roach and W. O. Roberts. Pp. ii+12. (East Malling: Imperial Bureau of Horticulture and Plantation Crops, 1945.) 1*s*. 6*d*. [238

Ovaltine Research Laboratories. Annual Report, 1944. Pp. 6. (London: A. Wander, Ltd., 1945.) [238

Other Countries

Commonwealth of Australia: Council for Scientific and Industrial Research. Bulletin No. 184: Fellmongering Investigations, Papers 1–12. By F. G. Lennox, Margaret E. Maxwell and W. J. Ellis. Pp. 232+8 plates. (Melbourne: Government Printer, 1945.) [317

Smithsonian Miscellaneous Collections. Vol. 104, No. 11: The West Atlantic Boring Mollusks of the Genus *Mariesia*. By Paul Bartsch and Harald A. Rehder. (Publication 3804.) Pp. ii+16+3 plates. Vol. 104, No. 12: The Solar Constant and Sunspot Numbers. By L. B. Aldrich. (Publication 3806.) Pp. ii+6. (Washington, D.C.: Smithsonian Institution, 1945.) [18

Preliminary Report on the Third Gujurat Prehistoric Expedition, by H. D. Sankalia and I. Karvé; and Human Remains Discovered So Far, by I. Karvé and G. M. Kurulkar. Pp. 16+9 plates. (Bombay: *Times of India* Press, 1945.) 6.8 rupees. [18

Indian Forest Records (New Series). Utilization, Vol. 3, No. 4: The Testing of Indian Plywood Tea Chests, and Suggestions for Establishing a Standard Type. By V. D. Limaye. Pp. 10+4 plates. (Dehra Dun: Forest Research Institute, 1945.) 9 annas. [18

Proceedings of the United States National Museum. Vol. 96, No. 3190: The Genus *Fundella* Zeller; a Contribution toward a Revision of the American Pyralidoid Moths of the Family Phycitidae. By Carl Heinrich. Pp. 105–114+plates 4–6. (Washington, D.C.: Government Printing Office, 1945.) [18

Forty-seventh Annual Report of the Carnegie Museum for the Year ended December 31, 1944. Pp. 37. (Pittsburgh: Carnegie Institute, 1944.) [18

Anglo-American Caribbean Commission: Committee on Agriculture, Nutrition, Fisheries and Forestry of the Caribbean Research. Fisheries Series, No. 2: Fresh and Brackish Water Fish Culture. Pp. ii+32. (Washington, D.C.: Anglo-American Caribbean Commission, 1945.) [18

New South Wales: Department of Mines, Geological Survey. Mineral Resources, No. 38: Part 1. The Gulgong Gold Field, by Leo J. Jones; Part 2. Magnetic Prospecting of the Gulgong Deep Leads, by J. M. Rayner. Pp. 168+5 plates. 9*s*. Mineral Resources, No. 39: Geology and Underground Water Resources of the East Darling District. By C. St. J. Mulholland. Pp. iii+80+3 plates. 6*s*. (Sydney: Government Printer, 1940.) [98

Catalogues

50 Years of Scientific Instrument Manufacture. Pp. 28. (London: Cambridge Instrument Co., Ltd., 1945.)

The Use of Cacodylates. Pp. 4. (London: R. F. Reed, Ltd., Barking, 1945.)

A Catalogue of Books, Old and Modern, in various Departments of Literature. (No. 498.) Pp. 38. (Cambridge: Bowes and Bowes, 1945.)

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