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Mechanism of Society

THE limitations which are being placed on scientific work in certain countries have forced many scientific workers, otherwise indisposed to concern themselves with political affairs, to realise that science and politics cannot be kept entirely apart. The direction of scientific investigation is in fact determined by social conditions to a much greater extent than is commonly realised by the scientific worker, and it is probably true that technological development rather grows out of than determines social needs. While science has undoubtedly been unjustly blamed for many of the evils which have resulted from the application of scientific discoveries, the danger of a reaction against science is sufficiently real to make it imperative for the scientific worker to pay much more attention to the social and political consequences of his work.

The limitations to which we refer, however, go far beyond this, and constitute a threat to the quality of scientific work as well as to its quantity or direction. They raise fundamental issues which cannot be evaded, and they could scarcely be more lucidly and forcefully put than in Lord Davies's book entitled "Force", which has recently been made available in a cheaper form*. This is essentially a scientific study of the right or moral use of force in every sphere of human society, and especially in international relationships.

While few in the world of science do not now realise the impracticability, if not the impossibility, of drawing a distinction between pure and applied science, there are still many who fail to realise that science on the scale it is pursued to-day is an

integral part of the social organisation of the State. Wherever he works, the man of science is a part of the machinery of State, and there is no real immunity of science from its political environment. If the scientific worker desires liberal endowment for his work and reasonable freedom in its direction, he must at least make an effort to secure the understanding and support of those responsible for the government of the State in which he serves.

In some countries to-day, that sympathy and support can only be secured at the price of the acceptance of particular political dogmas and views which are in the lineage of those credulities and superstitions from which in the past science has liberated the human soul. It is not merely the quantity and direction of scientific work that are involved. Reason is again being pitted against passion and prejudice, and the shackles which we once thought science had finally shattered are in danger of being riveted again, perhaps even more firmly, on the minds of men.

Under such conditions, the quality of scientific work cannot long remain untainted, and this reason alone should quicken the interest of the scientific worker in Lord Davies's theme. Moreover, when many, both within the ranks of science and without, are coming to consider the ways and means by which the work of government can be more and more based on a scientific study of the available facts, and less and less upon mere prejudice or guess-work, we are witnessing in one country after another the sweeping away of individual rights, systems of justice and hard-won political liberties.

In such circumstances, it is imperative to

* Force. By Lord Davies. Re-issue. Pp. x+242. (London: Constable and Co., Ltd., 1935.) 3s. 6d. net.

discover the fundamental causes of these failures whether in the national or international sphere. Lord Davies finds it simply in the failure to recognise and act upon the fundamental principle that the exercise of force should be limited to the police function. Force is either the servant of justice or the tool of policy, and in a series of lucid and forceful chapters he shows how failure to recognise this principle is the root cause of the loss of liberty and the growth of political oppression and tyranny in Europe to-day, as well as of the failure of the League of Nations to develop into an international authority with the power to ensure justice and peace.

Examples are quoted from recent history in a masterly manner in support of this thesis, including some trenchant criticism of the Irish policy of successive British Governments, but always Lord Davies is honestly endeavouring to face the facts in post-War Europe and to supply a moral basis for dealing with the most urgent problems of to-day. Inevitably he comes once more to his well-known view that force can only be rightly employed in the international sphere when it has been scientifically organised as the sanction of international law in the form of an international police force.

The issues with which we are faced in this way are urgent. Without dwelling unduly on the horrors of modern warfare, Lord Davies reminds us of our fatal habit of thinking of the next war in terms of the last and failing to face the facts of a scientific age. We cannot take all the powers and advantages with which science has now endowed us without in certain directions accepting restrictions upon our freedom of action, whether in such a matter as the use of the highways or in this matter of the use of force. The measures now being taken by the Air Raid Precautions Department of the Home Office will delude no reasonable person into thinking that any effective defence against air attack is possible, short of the abolition of war.

Lord Davies maintains that the only defence against a potential aggressor is to implant in his mind the certainty of an overwhelming reprisal by a superior force, under the control of an international executive and backed by the moral support of an impartial authority such as the League of Nations. The weakness of the collective system without such an international police force ready for instant action against an aggressor is apparent, and no thinking man can be blind to the narrow-

ness of the verge between the downfall of the collective system and international anarchy and disaster. This is a matter which concerns the scientific worker and every other citizen of good will. The vast increase in the potentialities of force during the last twenty-five years through the application of scientific discovery and invention indeed lay special responsibility on the man of science to assist in working out a solution.

If the primary task is one of education, scientific workers have definite responsibilities in that work. They must lend all their energy to the creation of a new mentality as favourable to the constructive use of force in national and international affairs as the old outlook on war has been hitherto in destruction. The peaceful evolution of institutions, whether on a national or an international scale, depends for its realisation upon the ability of men to agree upon the purposes they must have in view. The whole process of politics depends upon the assumption that reasoned discussion will secure effective agreement about whatever elements of justice are to be found in any proposed arrangement, such as an international police force; and in securing such agreement scientific workers must play a part neither more nor less than that of other sections of the community.

In the present structure of society, the participation of the technician and scientific worker, as of the administrator and professional worker, is indispensable, if that inherent tendency of institutions, which have once rendered invaluable service but are now archaic and declining, to delay the evolution of new and more appropriate institutions, is to be overcome by constitutional means. Adaptation is the secret of existence; and it is only as we accept the challenge thrown down by these issues and seek to develop by clear and courageous thinking and bold experiment that society can avoid self-destruction, and turn its new powers into instruments of security. Creative and adventurous thinking as well as a scientific approach are demanded, and scientific workers must recognise their responsibilities and utilise to the full those opportunities of creative work which lie before them in this field. In this way the dark menace which now overshadows the world may be dispelled, the limitations on human thought removed and science regain its full freedom of creative endeavour, while new fields of effort will be opened up in which the scientific method and spirit may win yet greater triumphs for the human race in its mastery of its environment.

The Beginnings of Applied Chemistry

Origins and Development of Applied Chemistry
By Prof. J. R. Partington. Pp. xii+597.
(London, New York and Toronto: Longmans,
Green and Co., Ltd., 1935.) 45s. net.

THE evolution of an idea or event usually makes a very interesting story, and probably none more so than the origins of some of the industrial applications of chemistry. Indeed, several of the modern chemical arts have been practised for thousands of years in forms which become more and more primitive and obscure as they are traced backwards, until at last their humble origins are lost in the haze of prehistoric antiquity.

Many charming stories have been written about one or other of those chemical industries the origin of which antedates all books and writings; although, in some cases, industries have passed through many strange vicissitudes in their development, and have been ultimately abandoned, for, as Lucretius has said:

The rolling years bring on a change of things;
What once was valued loses all worth,
And what was worthless rises in its stead.

In the work under notice, Prof. Partington has presented a wonderful and valuable account of the sources, production and uses of materials in Egypt, Babylonia, Assyria, the Ægean, Asia Minor, Persia, Syria and Palestine, from the earliest times to the end of the Bronze Age—"wonderful" because of the painstaking care in handling so large a mass of evidence involving, we are informed in the preface, 7,000 references; and "valuable" because it supplements so effectively and pleasantly our general knowledge on the historical side of industrial chemistry.

Each territory is treated as one unit, so that the origin, occurrence, manufacture and use of a given material, say, iron, are described country by country. Some might consider that it would have been better to have collated the data with reference to each material, as E. O. von Lippmann did towards the end of his "Entstehung und Ausbreitung der Alchemie" (Berlin, 1919-31). I think that Prof. Partington has adopted the better plan; the alternative would probably have been preferable had the narratives extended through the Middle Ages.

The materials treated in Prof. Partington's book include the metals and alloys: copper, silver, gold, zinc, brass, mercury, tin, bronze, lead, arsenic, antimony, iron and steel, cobalt, nickel, and platinum; and various chemical compounds—

common salt, natron, sal ammoniac, nitre, alum and vinegar—as well as sulphur; the gem-stones—natural and artificial; building materials—plaster, stucco and bricks; pigments and paints; ink for writing; oils—expressed and distilled; pomades and ointments; incense and perfumes; products derived from plants; medicinal preparations; and fermented drinks and other beverages. There is a temptation to select one or two items in the list to illustrate in detail how thoroughly the work has been done, and to compare that work with evidence collated in other ways.

Operations connected with the arts of metallurgy, dyeing, weaving textiles, tanning leather, brewing, baking, embalming, pottery, glass-making and the imitation of gem-stones, are also described. Here we can see the beginnings of many an industry practised in modern times; and that not always to the credit of the later workers, judging by what they have accomplished with their heritage—*St. Matthew xxv, 25.*

The data confirm M. Berthelot's belief that chemistry is founded on knowledge slowly accumulated by practical discoveries in metallurgy, medicine and other arts; and the opinion of J. B. A. Dumas when he said:

Let us confess at once, without going round the subject, that practical chemistry took its rise in the workshops of the smith, the potter, the glass-blower, and in the shops of the perfumer.

Of course, the mere mechanical practice of operations, essentially chemical in their nature, does not make the early artisans into chemists in anything but name. Otherwise, the first man to light a fire, stew a rabbit, or roast a pig might have been styled the father of chemistry. In the words of A. F. de Fourcroy (1782):

It is vain and ridiculous to attempt to trace the origin of chemistry to the first men who worked in the metals, cut and polished stones, fluxed sand, or dissolved and crystallized the salts. This would be analogous to an attempt to trace the elements of geometry in the efforts of the savage to trim irregular fragments of rock to a more regular form in order to adapt them to his first needs.

The index is worthy of the book; it is singularly complete, occupying as it does 65 pages, three columns per page. It is difficult to see how those interested in the subject can carry on economically without the assistance of the "Origins and Development of Applied Chemistry".

J. W. MELLOR.

Gymnosperms

Gymnosperms: Structure and Evolution

By Dr. Charles Joseph Chamberlain. Pp. xi + 484. (Chicago: University of Chicago Press; London: Cambridge University Press, 1935.) 21s. net.

EVEN in these days of specialisation, no real botanist dismisses the Gymnosperms from his field of study. They still possess an inherent interest, although for a hundred years they have been classic ground. The first impulse came from Robert Brown, who first realised the morphological significance of the Gymnosperms. From that beginning the knowledge of them has been built up by generations of botanists, from Hofmeister, to D. H. Scott in our own day. The attraction of the group depends on the strategical position which they occupy in relation to Angiosperms and Pteridophytes, respectively. This morphological and evolutionary ascendancy really derives from the fact that Gymnosperms abut on a rich hinterland of fossil petrifications so well preserved that their investigation has given, and should continue to give, convincing results. All this is fully appreciated by Prof. Chamberlain, and forms indeed the *raison d'être* of the present book.

American botanists have taken an important share in the advancement of Gymnosperm knowledge, owing to (1) the large numbers of living conifers which grow in the forests of the North American continent, the life-histories of which have been worked out, especially by the school of Coulter and Chamberlain at Chicago; (2) the richness of the country in Bennettitales as elucidated by Wieland; and (3) the intimate studies of living Cycads by Prof. Chamberlain himself, who in his world-wide travels has seen, studied and collected, in its own habitat, every genus and a large number of species of existing Cycads. This contact with his material in the field is an admirable and outstanding feature of his book. In this connexion, frequent reference is made to the question whether Gymnosperms are ever effectively pollinated by insects. The matter is one of importance as on its determination must rest any decision as to whether evolution at the Gymnosperm stage has been influenced by insects, as it undoubtedly has been in the more modern Angiosperms. Prof. Chamberlain is sceptical as to existing evidence: "In spite of occasional claims, it is very doubtful whether there is a single case of insect pollination in any Gymnosperm".

All the same, it is an attractive and important

field for properly directed and methodical investigation, because much depends upon it. In some Palaeozoic seeds, for example, *Physostoma*, as many as four hundred pollen grains have been counted in the pollen chamber, and it is difficult, unless a very prolonged exposure of the micropyle be presumed, to account for such bountiful supplies on the hypothesis of wind carriage alone.

The book has a definite style of its own which may be best compared to the 'running commentary' of the broadcaster. Otherwise stated, a previous knowledge of the subject matter is required for benefit to be derived. To say this is not to condemn the book (which indeed is brightly written) though it does cast some doubt on its utility for the purposes of undergraduate students (cf., dust cover). The comparative morphology, anatomy and embryology of the various living groups of Gymnosperms are well displayed, though too many dogmatic statements have crept into the text. The illustrations are excellent and many previously unpublished. If anything, they are too generously provided, and a few of the redundancies might be usefully replaced by distribution charts.

It is natural that the book should (apart from the non-Cycadian fossils) be based largely on American researches, as these have been a great feature in the output of the Department of Botany at Chicago, as developed by the late Prof. J. M. Coulter and his colleague, Prof. Chamberlain. For the fossil data (other than Bennettitales) the results of European work have been incorporated, and indeed form the evolutionary foundation of the book. Lack of practice in palaeobotanical technique is responsible for a few fantastic statements, but they are not real blemishes. Though America has not yet made available the relevant petrifications that would have made this book 100 per cent American, the author gets his revenge by taking his readers for a personally conducted tour through the beautifully arranged and reconstructed carboniferous forests of the Field Museum at Chicago! Nothing approaching these exists in Europe.

Prof. Chamberlain reproaches his "English friends" for their persistent use of the name Pteridosperms for seed-bearing plants having the habit of ferns—and employs the term Cycadofilices. Reference to the original source (No. 431 in the Bibliography), where this group was established, would disclose the grounds for so doing, together with the reason why "Cycadofilices"

seemed inadequate. This latter name had been proposed by Potonie to cover the whole series of vegetative remains showing structural relations with both Ferns and Cycads. The term Pteridosperm is reserved for the elect among these—to be included if and when they are proved to have

possessed seeds. The unassigned residue (which may remain in the convenient 'waste-paper basket' of Cycado-filices) should include both unverified Pteridosperms and perhaps other plants which never attained to the status of seed-bearing.

F. W. O.

X-Rays in Pure and Applied Science

(1) Handbuch der Physik

Herausgegeben von H. Geiger und Karl Scheel. Zweite Auflage. Band 23, Teil 2: Röntgenstrahlung; Ausschliesslich Röntgenoptik. Redigiert von H. Geiger. Pp. ix+541. (Berlin: Julius Springer, 1933.) 56.70 gold marks.

(2) Industrial Radiography

By Dr. Ancel St. John and Herbert R. Isenburger. Pp. ix+232. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1934.) 21s. 6d. net.

(3) Les rayons X: au laboratoire, à l'hôpital, à l'usine

Par Marc Privault. (Actualités scientifiques et industrielles.) Pp. 204. (Paris: J.-B. Baillière et fils, 1934.) 25 francs.

THESE three books, very different in type and in object, serve to illustrate the intensely specialised nature of modern physics, and also the high degree of specialisation within its fairly clearly defined sub-branches.

(1) The second edition of vol. 23 of the well-known "Handbuch der Physik", edited by Geiger and Scheel, treats of several branches of radiology from the academic point of view. The confines of one volume have proved inadequate for the revision of a subject growing so rapidly, and vol. 23 now appears in two parts. In part 2, Profs. Bothe and Kirchner deal with the absorption and scattering of X-rays, Dr. Kulenkampff writes on the continuous X-ray spectrum, Prof. Ewald discusses the study of the solid state by means of X-rays, and Dr. Steinke contributes a section dealing with cosmic rays.

The contributions of Bothe and Kirchner and of Kulenkampff are considerably longer than those of the first edition, and bring the topics up to date. The section by Ewald, which is new, opens with a clear and detailed account of crystal classification and space-grouping, deals adequately with X-ray interference, temperature and atomic effects, and the design and use of X-ray spectrometers. A very valuable chapter deals with the interpretation of powder photographs and the usual projections

used in this work. The rapid advance of the study of cosmic radiation is shown by the fact that, although the subject has only been seriously investigated for some seven years, the physical nature and properties of the radiation are now fairly well known. Much, however, remains to be done before we have a clear understanding of the origin of the cosmic rays. That they originate in space appears to be beyond doubt, but whether their occurrence is due to atomic disintegrations in young stars or spiral nebulae, whether they arise through some interaction of interstellar matter with electrified particles (or perhaps neutrons), or whether their genesis is due to some physical phenomenon at present outside our knowledge is one of the problems which is yet to be solved. The experimental side of the work is set down in considerable detail by Dr. Steinke, together with a brief but adequate summary of the somewhat speculative theories of the origin of cosmic rays.

One cannot praise this volume more highly than by stating that it maintains to the full the high standard set by the other and well-known volumes of the "Handbuch der Physik".

(2) "Industrial Radiography" by St. John and Isenburger is a treatise for the technician, and within the limits of its title is self-contained and complete. The first seventy pages contain an account of the general properties of X-rays and the construction of X-ray apparatus which will probably be found adequate for a proper understanding of the later parts of the book. The importance of a proper photographic technique and accurate dark room manipulation of films is rightly stressed. One frequently finds operators taking great pains in adjusting objects to be radiographed, making exposures with carefully controlled voltages and exposure times, and then developing and fixing in stale solutions at unsuitable temperatures, apparently unaware that such processing conditions give radiographs in many respects similar to those which would result from using quite different kilovoltages and exposure times. The importance of using dark rooms of

ample size and provided with good ventilation is also emphasised.

Industrial radiography is largely concerned with making radiographs of metal objects, often with thick walls and of irregular shape, and the correct setting up of such objects frequently presents difficulties. The authors have apparently had a very wide experience of this work, and have included in the book a large number of practical points which are likely to be of great service to those whose experience is more limited. Similarly, the radiography of small objects has its own peculiar problems, which again are dealt with adequately.

A chapter is devoted to radiography with radium gamma rays (the authors call the resulting pictures 'gammagraphs' to distinguish them from X-ray pictures which they call 'exographs'), a method of attack which seems likely to increase in use, particularly since the influence of scattering on the radiographs is much less with gamma rays than with X-rays, and therefore much thicker objects may be successfully examined.

The book is characterised by a large number of illustrations carefully chosen to show how common defects in metals appear on radiographs.

In very many cases the radiograph appears by the side of a photograph showing the defect, and not infrequently photomicrographs are also given.

An appendix contains a valuable set of exposure charts showing the exposures required at various voltages for various thicknesses of aluminium, steel and copper, a chart from which the exposure required for gamma ray radiography of steel objects may be found and also a very complete bibliography.

The authors are to be congratulated on producing a practical treatise which should be invaluable to novices and a useful reference work for all industrial radiologists.

(3) "Les rayons X" by Privault is an introductory textbook, touching on all the principal aspects of X-rays from the points of view of both pure and applied science. With so comprehensive a field, it must follow that the treatment of each branch of the subject is somewhat meagre. One feels that it is impossible to give even a reasonably adequate summary of the present state of all the branches of radiology (using the word in its widest sense) within the limits of two hundred small pages.

The Profession of Librarian

Rôle et formation du bibliothécaire :

étude comparative sur la formation professionnelle du bibliothécaire. (Dossiers de la Coopération intellectuelle.) Pp. 385. (Paris: Institut international de la Coopération intellectuelle, 1935.) 50 francs.

THIS volume is based on a questionnaire sent out by the International Institute of Intellectual Co-operation, and it provides the most detailed account of the status of librarians in various countries which has yet been published. Thirty-five countries or States are included in the survey, of which twenty-seven are in Europe, the others being South Africa, Brazil, Canada, China, the United States, India, Japan and New Zealand. The information asked for by the questionnaire related to the categories of librarians and libraries existing in the country concerned, the authorities to which they were subject, the qualifications required of candidates for the library profession, whether and what diplomas or other examinations were available and the particular courses of study provided in connexion with them, and their location and control.

The work should prove of the greatest value to

all interested in the library profession and the improvement of librarianship as a whole. It is very desirable that the volume should have a wide circulation so that the people of all countries may realise that the average librarian is required to know a great deal more than how to hand books out to a reader. It is gratifying to note the progress that has been made in recent years, and especially since the War, in many countries to ensure that librarians shall be men and women of high educational standing and that their emoluments shall be reasonably adequate. In the Netherlands, for example, every public library official is expected to hold a special diploma, and any Government subvention is withheld from a library the personnel of which is wholly or in part without a diploma.

The chapter on England is written by Mr. J. D. Cowley, director of the School of Librarianship of the University of London, and is an admirable summary of the organisation of libraries and the facilities for the training of librarians now available. It is interesting to note that candidates for a librarianship in Brazil have to produce, among other things, a certificate of good manners, as well as one of good health. Even in China, since 1927,

intending librarians have to pursue a course of study in a school of librarianship in China or elsewhere, possess a diploma of a university or college and also practical experience of more than one year, while junior assistants must possess a certificate of secondary education.

Possibly the most extensive course is that in Russia, where no fewer than twenty-four colleges of library economy have been founded. Admission to a college is granted to persons who have terminated a secondary school course of seven years, and the plan of study in the library college extends over three years, a total of 4,426 hours being allocated to the different subjects, which include physics, chemistry, mathematics and graphic processes, in addition to the strictly professional topics. Of special interest is the fact that, of the 1,440 hours of study allocated to the third year's studies, 82 have to be devoted to Leninism.

The introductory chapter summarises the results of the inquiry, and recommends the development of international collaboration by the foundation of an international series of courses or conferences, attached to a university or an institution controlled by some national authority, for the purposes of further research in library economy, as an experimental measure, the necessary finance being assured by Governmental subventions from all interested parties. A bibliography of twenty-six pages, geographically arranged, is not the least valuable section of this work, which should be found on the shelves of every library anxious for the betterment of itself, its staff and its service to the community.

B. M. HEADICAR.

Technical Aspects of Emulsions :

being the Papers read at a Symposium held in London, December 7th, 1934, under the auspices of the British Section of the International Society of Leather Trades' Chemists. Pp. vi+150. (London : A. Harvey, 1935.) 6s. net.

THE twelve sections of this book concern the physical chemist, the physician, the patent agent, the engineer, and the technologist in many industries (laundry-work, agriculture, food-preparation, woollen-textiles, varnish, leather, rubber, bitumen).

Diversity was the aim of the symposium and the book is witness to the attainment of that aim. This prompts the thought that, in books of this kind, there may be a place for the thread of unity which runs through diversity. The reviewer turned to the first section, that on the mechanism of emulsification, hoping there to find that thread traced through the other papers. He found, instead, a stimulating account of the effect of ultra-sonic waves in making and breaking emulsions : a piquant *hors d'œuvre*.

Diversity without unity has its drawbacks. Words are used loosely. On p. 93 the word 'nucleus' means

the oily part of mayonnaise emulsified with some of the aqueous part thereof. The physicist uses the word in another sense, the biologist in yet another. Perhaps there is not much harm done ; but there may be some. Dialects tend to be both used and confused. From confusion to obscurity is but a step. The passage at the bottom of p. 4 is rather near obscurity : "A device of this kind might be characterised by the fact that the droplets formed travel parallel to another with different velocity along a too great a distance and that this may cause an orthokinetic coagulation".

Nevertheless the sections of the book are well written. That is the reason why a faulty passage strikes the eye. Some sections are good descriptive catalogues with references by the hundred ; others have a philosophic turn ; yet others are both bibliographical and philosophical ; all are illuminating ; one is of outstanding interest, namely, that on the use of highly dispersed emulsions in the treatment of toxæmic conditions. The compilation is the record of an important symposium meant to be diverse in treatment.

F. S. A.

Mathematik im Dienste der nationalpolitischen Erziehung mit Anwendungsbeispielen aus Volkswissenschaft, Geländekunde und Naturwissenschaft : ein Handbuch für Lehrer. Herausgegeben im Auftrage des "Reichsverbandes Deutscher mathematischer Gesellschaften und Vereine" von Adolf Dörner. Pp. iv+118. (Frankfurt am Main : Moritz Diesterweg, 1935.)

THIS book is intended to provide teachers of mathematics with examples connected with the aims of the National Socialist Government. The book is not a persistent exposition of the logic of any part of pure or of applied mathematics. It is a collection of detached chapters, explaining in words various matters which both interest the Nazis and are capable of simple quantitative treatment. Formulæ which are important are stated ; but mostly without proof. Numerous examples are given, with algebraic or arithmetical answers.

The remarkable aspect of the book is the selection of subject matter. Broadly, one may say that there are 59 pages of social statistics and 49 pages of military geometry. In the statistical part one finds explanations of means, standard deviations and correlations ; also treatments of life-insurance, of savings banks, of Mendelism, of unemployment, of the birth-rate, of trade and food supply. At the end of the book there are 15 pages of German statistics. An interesting diagram (on p. 23) shows the great contrast between the age-distribution of Germans in 1931 with that in 1910.

The part of the book here described as military geometry deals with map-reading, with aerial navigation, with protection against bombs dropped from above, with the paths of projectiles *in vacuo* and in air, also with sound-ranging. Except for these, the ordinary applications of mathematics to mechanics and to physics are notably absent. The words *Stimme* and *Wahl* (= vote, election) do not appear in the index.

L. F. R.

A New Angle on Health

(Nature's Provision for the Health and Happiness of Mankind). By Surg.-Capt. D. H. C. Given. Pp. xvii+160+5 plates. (London: John Bale, Sons and Danielsson, Ltd., 1935.) 7s. 6d. net.

THE author of this book was for more than eight years stationed at Singapore, and this he claims has given him a unique opportunity to contrast the health of a primitive Asiatic community of diverse races with that of naval personnel and white civilians. He finds that the physical standard of the Asiatic labourer is *A 1*, as compared with the *C 3* standard of civilisation, that his teeth are on a par with his physical standard, and that he does not suffer from the diseases common among Western races.

It is to be noted that in the Asiatic labourer of Singapore, the author is dealing with a very selected and restricted group, which cannot be compared with our own population as a whole. Similarly, when it is stated that in contrast to the European, the epidemic influenza in the Asiatic in 1931 was mild and free from complications, it should be recalled that India and South Africa suffered some years ago from a devastating epidemic of influenza, and this disease in native races is not necessarily a mild one; in fact, one epidemic may differ entirely in severity and in incidence from another one.

Basing his arguments on what in many instances we believe are faulty premises, the author attributes the ills from which we suffer to the effects of urbanisation, overcrowding, extremes of poverty and riches, the decline of agriculture, and under- and improper feeding—much of which is doubtless true—and condemns our Western civilisation as being founded on selfish greed, industrialism and parasitism. He concludes that so long as selfishness continues to dominate the lives of men, so long will the human race fail to realise the happiness for which it strives, and that the precepts of Christianity form the only basis of a healthy and happy life. R. T. HEWLETT.

Technics and Civilization

By Lewis Mumford. Pp. xi+495+16 plates. (London: George Routledge and Sons, Ltd., 1934.) 18s. net.

THIS book provides an interesting and thought-provoking contribution to the history of the machine and its sociological effects on humanity. Mr. Mumford divides the machine age into three great periods: (1) the 'eotechnic' based on animal, water and wind power; (2) the 'paleotechnic' which came in with Watt's steam engine and had its basis in coal and iron, and (3) the 'neotechnic' which is now dawning and promises industrial decentralisation, cleanliness, leisure and abundance, its basis being the long-distance transmission of electric power.

Discussing the assimilation of the machine, Mr. Mumford points out that as machinery was developed, attention came to be centred more and more on the product, people valuing the machine for what it produced. The machine thus appeared purely as an external instrument for the conquest of the environment to the neglect of the actual forms of the products, the actual collaboration and intelligence

manifested in creating them and the educational possibilities of this impersonal co-operation itself. The objects rather than the spirit that produced them were assimilated, and so far from respecting that spirit, the aim was to make the objects themselves seem to be something other than the product of the machine. The industrialists and engineers themselves did not believe in the qualitative and cultural aspects of the machine. The possibility that technics had become a creative force which was rapidly ordering a new kind of environment and producing a third estate midway between Nature and the humane arts, was far from the minds of those who actively promoted the mechanisation of production.

The Recollections of a Geographer

By E. A. Reeves. Pp. 224+8 plates. (London: Seeley, Service and Co., Ltd., n.d.) 8s. 6d. net.

AFTER fifty-five years service in the Royal Geographical Society as map curator and instructor in surveying, Mr. Reeves retired in 1933. Many hundred travellers and explorers have owed to him all they knew of survey work, so that his influence has reached to every corner of the globe. Here are glimpses of men like Stanley, Bates, Burton, Nansen and many others who brought their observations and discoveries to the Society.

Mr. Reeves has anecdotes about many and a kindly word for all. He has allowed no adverse criticism to appear in his pages; but he has clearly omitted many of his experiences, for the book is not long as a record of half a century of noteworthy people. A hurried sketch of the progress of exploration and survey in that period is included as well as some account of Mr. Reeves's own work on magnetism and in the improvement of surveying instruments. Finally, there is an unconvincing chapter on the author's psychic experiences.

It is a kindly and ingenuous book that to many will recall a teacher of great ability and untiring patience, and to others will appeal as a sketch of fifty years of discovery as seen from the Royal Geographical Society, by the one man above all others who has directed exploration.

Diesel Engine Design

By Harold F. Shepherd. Pp. vii+277. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1935.) 17s. 6d. net.

THE Diesel engine has now been constructed successfully in so many different types that any book on its design which is not restricted to one particular line of development must almost necessarily become too discursive to be of practical value to the designer. It is in this respect that H. F. Shepherd's "Diesel Engine Design" fails to meet the real need for a book or series of books on this subject. The historical and descriptive treatment and the discussions on numerous points which arise in design are all to the good; but the author does not really grapple with the actual problem of design until the last chapter or two. It is an introduction to, rather than a manual on, design. J. A. C.

Wave Action on Vertical Wall Breakwaters

By Dr. Brysson Cunningham

THE efficacy of the resistance to wave action of vertical wall breakwaters built on a rubble mound foundation has been called into question recently by reason of two unfortunate, and, in fact, structurally disastrous, incidents which have been experienced, at Catania in Sicily in March 1933 and at Algiers in North Africa in February 1934. The matter is one of fundamental importance, since quite a number of important harbours in the Mediterranean and elsewhere are protected by breakwaters of this type. It was discussed at considerable length by an eminent Italian engineer, Prof. E. Coen Cagli, in a lecture which he delivered lately at the Institution of Civil Engineers, a short reference to which was made in *NATURE* of July 20, p. 99.

The vertical wall breakwater is, in principle, a homogeneous or at any rate, so far as may be practicable under the conditions of the site, a coherent structure, generally formed of prismatic concrete blocks properly coursed and bonded, in contrast to the mound breakwater which consists essentially of a mass of rubble stone of various shapes and sizes deposited more or less at random on the sea floor and sometimes surmounted by heavier artificial units. The two types are, therefore, strikingly different in character, though it is rare to find a pure example of either, since the rubble mound is frequently capped with a coping course and parapet of blockwork, whereas the wall, when the site is in water of considerable depth, has generally to be founded on a bed of rubble, on account of subaqueous constructional difficulties and also from motives of economy. Moreover, at a certain depth below the surface, it is known that wave action ceases to produce any appreciable disturbance in a rubble mound foundation.

By way of illustration, it may be said that the harbours of Dover, Tynemouth and Peterhead in Great Britain are of the vertical wall type, while an excellent example of the mound type is to be found in the outer breakwater, or "Grand Jetée", at Marseilles.

Until comparatively recently, despite its importance from a scientific as well as a practical point of view, experimental research into the phenomena of wave action had not been conducted on any systematic lines. It is true that individual observations have been recorded from time to time and valuable deductions made therefrom by several scientific writers, but from lack of official co-

operation and financial assistance the data so obtained have been somewhat fragmentary and incomplete. It is satisfactory to note that at the port of Genoa a very efficient apparatus is now installed for the purpose of taking continuous records. Into the outer breakwater at a suitably exposed point has been built a special monolith, or hollow block (Fig. 1) containing apparatus whereby at a series of successive levels ranging from 10 metres below to 3 metres above sea-level, piezometric values of wave stroke are recorded both mechanically on the spot and also by electrical transmission to a wave oscillation register situated in the sheltered area of the inner harbour. By means of this apparatus a number of valuable pressure records and 'oscillograms' has been obtained and described by Dr.-Ing. Salvatore Levi¹. An account of the installation has been published by Commendatore Ing. Albertazzi, the Chief Engineer of the port².

It is not proposed in this article to discuss the numerical values of wave pressures recorded by this and other means, but to direct attention to the general principles and conditions of stability of vertical wall breakwaters in the light of the instances of failure which have occurred at Catania and Algiers. I had an opportunity, while in Sicily recently, of discussing the former breakwater with Signor A. D'Arrigo, who was associated with its construction, and last year, at Algiers, I similarly discussed the causes of the collapse of the second arm of the Mustapha Jetty with Monsieur P. Rénaud, the Engineer and Port Director there.

To commence with, it is to be noted that there was an essential difference in construction between the two breakwaters, cross-sections of both of which are given in Figs. 2 and 4. Both were founded on rubble mounds, the first (Catania) at a depth of 12.5 metres below sea-level, and the other (Algiers) at 15 metres below sea-level; but, whereas the Catania mole consisted of a series of disconnected piers, 12 metres in transverse section, made up of 320-ton concrete blocks, each 12 metres by 4 metres by 3.25 metres, unbedded and unconnected in any way by cement joints or reinforcement, the piers of the latter, 11 metres across in transverse section, were welded into a

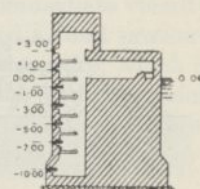


FIG. 1. Wave pressure recording monolith at Genoa.

monolithic whole by means of vertical wells, or shafts, filled with concrete reinforced by steel bars.

Now as to the circumstances of collapse. While in course of being lengthened, the Catania mole had already suffered damage from an east to south-east storm (without wind) on February 22, 1930, which engendered waves of 7 metres height and 200 metres length. Some horizontal displacement of the courses took place and

there was also a vibratory motion observed, due to the uplifting action of the waves on the underside of the blocks, and that this was the primary cause of fracture.

In the case of the Mustapha Jetty, on the other hand, the monolithic piers of which it was composed remained intact under wave impact until they were finally overturned. The north-easterly tempest of February 2-3, 1934, which caused the

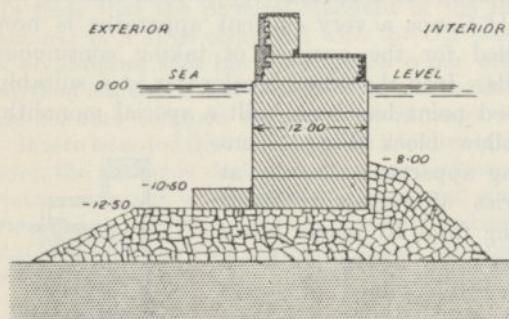


FIG. 2. Catania breakwater as constructed.

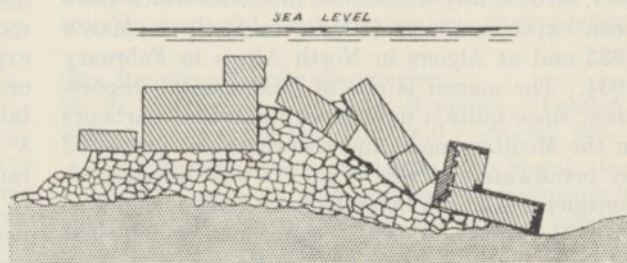


FIG. 3. Catania breakwater after demolition.

a part of the work was dismantled. The damage, however, was made good without any change in the design, beyond raising the platform on the harbour side by a height of 1 metre, with the view of increasing the load on the piers. The first arm of the jetty had then been built out to its full length when another storm of more exceptional severity from the north-east, with waves 7.5 metres in height and 230 metres in

collapse of 401 lineal metres of the mole, was accompanied by waves of 9 metres height and 300 metres length². The vehemence of the wave stroke, however, failed to overturn the wall by direct impact, to which effective resistance was offered for many hours. Failure, when it occurred, was due to the powerful suction of the recoiling waves, which drew down the rubble mound and scoured out a trench in the sea floor at the foot

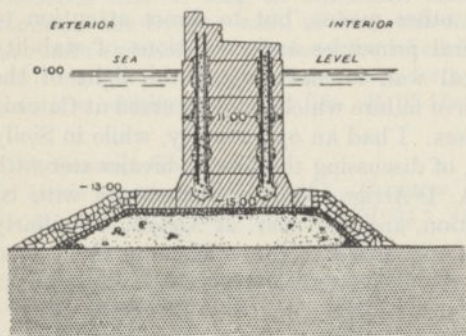


FIG. 4. Mustapha Jetty, Algiers, as constructed.

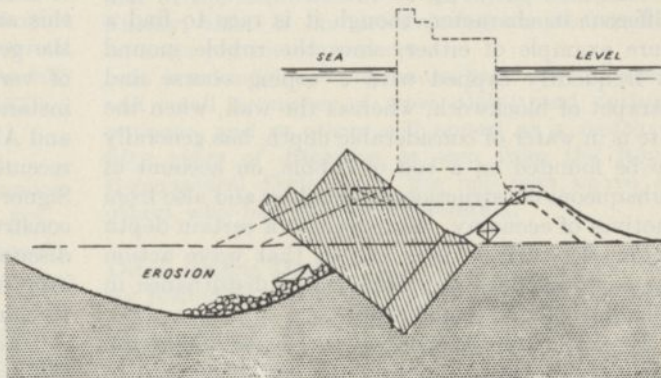


FIG. 5. Mustapha Jetty, Algiers, showing process of collapse.

length, broke on March 26, 1933, and completely demolished the work for a length of 700 metres, the parapet wall and successive layers of blocks above the two lowermost courses being swept into the harbour, in some cases a distance of as much as 40 metres, and more or less fractured and disintegrated. It is to be noted, as can be seen in Fig. 3, that the blocks in the process of displacement slid over one another, due to the lack of adhesion at the joints. Signor D'Arrigo states that

of the wall, into which the latter subsided, as shown in Fig. 5, and then disintegrated. There is every probability that had the rubble mound been able to resist the suction of the 'back-draught', the wall itself would have come through the ordeal with but slight, and certainly not irreparable, damage.

The view expressed in his lecture by Prof. Coen Cagli, who, it should be stated, was mainly responsible for the introduction into Italy of the

vertical wall breakwater, is that neither of these untoward incidents justifies a condemnation of the type, which in every case other than Catania in Italian seas, has demonstrated a satisfactory stability. This view commends itself as perfectly reasonable and Prof. Cagli is fully justified in maintaining, that if, in the case of the Catania breakwater, the wall had been monolithic in structure instead of consisting of a vertical series of disconnected blocks, imperfectly bedded; and if, in the case of the Algiers breakwater, the rubble mound foundation had been made sufficiently resistive to suction and undermining, neither of the storms, despite their unprecedented severity, would have been likely to produce the serious results which actually occurred. It has been decided, however, that both breakwaters are to be reconstructed as rubble mounds without vertical wall superstructures. In the case of the Algiers mole, this was perhaps inevitable from a consideration of the nature of the sea floor and the accumulation of debris from the old work.

In consonance with a resolution passed at the fourteenth International Congress of Navigation at Cairo in 1927, a special committee of experts from various countries, including Sir Leopold Savile as representative of Great Britain, has been engaged in investigating the problem of wave action, and the installation at Genoa above referred to constitutes one of the avenues of research. Prof. Cagli has himself been conducting a series of experiments with small-scale models in co-operation with Prof. A. Stucky at the Hydrological Laboratory of the University of Lausanne. The results obtained from the tests carried out up to the present were given by Prof. Cagli in his lecture, and they may be briefly summarised as follows:

(1) The complete agreement of the actual pressures recorded at Genoa with those obtained by means of tests on the model of the Principe Umberto Mole at that port indicates, on one hand, that the method of research by tests on small-scale models, based on the law of mechanical similitude, is strictly applicable to the study of wave stroke, while, on the other hand, it demonstrates, contrary to the opinion expressed by some writers on the subject, that oscillating waves, in violent storms at any rate, are not converted by reflection at a vertical wall into actual 'standing waves' (Ital. : *onde stazionarie*; Fr. : *clapotis*), but maintain their

essential trochoidal characteristics with a modified orbital movement and that they exert pressures which notably exceed those of actual standing waves of the same magnitude. For example, it was found that the total effort at Genoa of a normal wave of 5 metres height and 110 metres length exceeds by 26 per cent the total effort which would be exerted by a standing wave engendered by the same ordinary wave and having therefore the same length with twice the height.

(2) The tests on a small-scale model of the Mustapha Jetty at Algiers have demonstrated (Fig. 6) that under the terrific conditions of the storm of February 3, 1934, with waves 9 metres high and 185 metres long in the immediate vicinity of the work, the wall experienced a total pressure of 147 tons per lineal metre of structure, which is greater by 35 per cent than the pressure which would have been exerted by a standing wave of

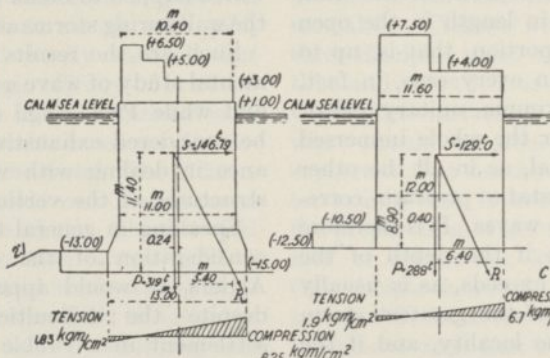


FIG. 6. Stability diagram, Mustapha Jetty, Algiers.

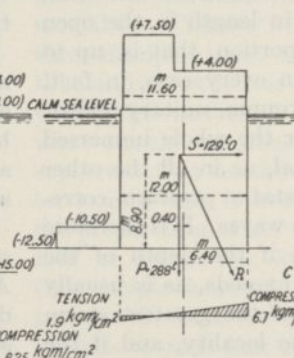


FIG. 7. Stability diagram, Catania breakwater.

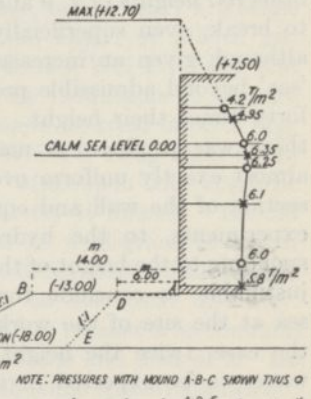


FIG. 8. Pressures exerted by wave 6.50 metres high, 155 metres long.

the same length and 18 metres high. As a consequence of this effort, the intensity of pressure on the rubble mound along the inner edge of the wall base should have amounted to 8.25 kgm. per sq. cm. (about 7½ tons per sq. ft.); certainly an excessive load, but one which, very likely, was not actually realised to the full calculated extent by reason of the intervention of certain impedimentary factors, such as the continuity of the mass concrete capping of the breakwater and the rise of the water inside the harbour as a result of the rise of level outside.

(3) The model of the Catania mole having, in turn, been subjected to the impact of waves 7.50 metres high and 155 metres long adjacent to the structure, similar to those observed in the storm of March 26, 1933, the result of the tests (Fig. 7) showed that the wall experienced a total pressure of 129 tons per lineal metre of structure, producing an intensity of pressure on the rubble foundation of 6.70 kgm. per sq. cm. (say, 6 tons per sq. ft.); a pressure which the wall, 12 metres thick, would clearly have withstood better than

the Algiers mole if it had been monolithic in character.

(4) The results of the whole series of experiments on small-scale models have enabled it to be established that the intensity of pressure exerted against a vertical wall by oscillating waves diminishes progressively above smooth sea-level in the ratio of two thirds of the height above this level. Thus, with a surface level pressure of 6 tons per square metre, at a height of 3 metres the pressure would be reduced by 2 tons to 4 tons per square metre. The pressure diagram is, in fact, substantially a triangle with a base angle of about 60° .

(5) In none of the tests with small-scale models relating to wall breakwaters at Genoa, Algiers and Catania, standing in depths of 15, 21 and 18 metres respectively and having their wall bases located at levels of -10, -13 and -10.50 metres respectively, could waves of the maximum observed heights of 7, 9 and 7.50 metres be caused to break, even superficially, in front of the wall, although given an increase in length in the open 'sea' beyond admissible proportion, that is, up to forty times their height. In every case, in fact, there was produced a maximum unitary effort, almost exactly uniform over the whole immersed section of the wall and equal, as in all the other experiments, to the hydrostatic pressure corresponding to the height of the waves. It is therefore justifiable to conclude that if the depth of the sea at the site of the work exceeds, as is usually the case, twice the height of the greatest storm waves to be expected in the locality, and if the base of the vertical wall lies at a depth of one and a half times the same height, there should be no danger of waves breaking completely against the work. Moreover, it has been possible to ascertain that under these conditions, the width of the benching at the foot of the wall and the inclination of the side slope do not affect in any way the intensity of stroke exerted by the waves against the wall (Fig. 8).

While under the foregoing conditions it is permissible to exclude the risk of complete breaking of the heaviest storm waves against the work, it is not impossible, however, that during storms accompanied by very strong wind, the waves, retarded in their propagation by the progressive decrease in sea depth and by the effect of the slope of the rubble foundation, may, under the influence of the wind, break superficially and so produce against a part of the face of the wall pressures which are more intense than would be those exerted by the same waves if they remained purely oscillating up to the moment of contact. Unfortunately, no observations or experiments so far made have provided data for the estimation of the intensity and distribution of these exceptional pressures, so that no precise indication

can be given of the additional strength required to withstand such shocks. However, it is to be noted, on one hand, that waves accompanied by strong wind are sensibly shorter than waves of the same height propagated in the entire absence of wind, with the consequence that the total effort exerted against the wall is considerably less in the first than in the second case; and, on the other hand, that the effort exerted by the breaking wave, which is purely dynamic and exhausts itself in a comparatively short time, affects the resistance of the wall to shear much more than to overthrow or slip. It follows, adds Prof. Cagli, that if the work be designed with the requisite margin of safety for withstanding oscillating waves of the maximum height for the locality, unaccompanied by wind, the monolithic structure of the wall, or its component piers, may be deemed sufficient to ensure the requisite stability in the event of an augmented stroke from waves of maximum height which happen to break superficially in approaching the wall during storms accompanied by strong winds.

Such are the results obtained from the experimental study of wave action on small-scale models, and while Prof. Cagli admits that they may not be considered exhaustive, they afford useful guidance in dealing with wave action in relation to structures of the vertical wall type⁴.

Speaking in general terms, as the outcome of a consideration of the disasters at Catania and Algiers, it would appear from the former that despite the difficulties arising from unequal settlement in a rubble foundation, a continuous monolithic wall is better adapted to withstand the known characteristics of wave stroke than a wall of detached superimposed blocks, even of cyclopean magnitude; and from the latter, that the action of the recoiling wave on the rubble mound and a soft sea bottom requires very careful consideration. Hitherto, it has been held with a certain amount of justification that the undulatory movement of the sea (which extends on a decreasing scale to considerable depths) is not likely to have much, if any, depreciatory effect on a rubble mound lying at a level of about 40 ft. below the surface of the sea. At Algiers the rubble mound was seriously disturbed and the sea floor eroded at depths considerably greater, even approaching double the figure in question. It seems essential, therefore, for complete security that the recognised standard should be reconsidered, and an appreciably increased depth adopted in situations where the 'fetch' is sufficient to promote the generation of waves of the order of 25-30 ft. in height and 500-600 ft. in length.

¹ *L'Ingegnere*, August 1, 1934.

² Bulletin No. 18 of the Comitato Nazionale Geodetico e Geofisico (July 1929); also *Annali dei Lavori Pubblici*, February 1932.

³ Vide *Engineering*, January 11, 1935.

⁴ See also: E. Coen Cagli, "Sulle condizioni di stabilità dei moli a parete verticale", *Annali dei Lavori Pubblici*, June 1934.

An Ancient Chinese Treatise on Alchemy

By Prof. J. R. Partington, M.B.E.

ONE of the early Chinese texts on alchemy is the *Ts'an T'ung Ch'i* of Wei Po Yang, who has been called the father of Chinese alchemy. His treatise has been regarded as the earliest work in the Chinese language which is devoted exclusively to the subject, although it is by no means the earliest Chinese writing which makes mention of alchemy. It shows, in fact, that a definite and extended tradition of alchemy was in existence when it was written, and it mentions several earlier alchemists who are otherwise known, either from their own writings or from notices in Chinese historical works. It seems reasonable to conclude that, for two or three centuries before Wei Po Yang, the Chinese had been engaged in an attempt to transmute base metals into gold, not because gold was intrinsically valuable but because of the supposed magic efficacy of artificial gold in prolonging life. This belief is found also in ancient Egypt¹ and is no doubt based on the unalterable character of the noble metal. The Chinese believed that an artificial gold could be prepared from cinnabar (mercuric sulphide) which would have a more powerful action than natural gold.

The early Chinese alchemical works attach considerable importance to the synthesis of cinnabar from mercury and sulphur and its resolution into its constituents². These operations also attracted considerable attention among the early Egyptian alchemists, the oldest of whose works, extant in Greek, are supposed to go back to the early centuries of the Christian era³, but may be based on texts a century or so earlier. Since Wei Po Yang lived in the second century A.D., and since alchemists are mentioned in Chinese records two or three centuries before this, it is evident that the origins of alchemy in China and in Hellenistic Egypt are practically contemporary. The oldest known works in both cases are of approximately the same date, and in both cases they mention earlier works and traditions—sometimes fabulously early.

It is, therefore, very difficult to decide with our present information whether the origins of alchemy in Egypt and China were independent or not, and, if they were, which was earlier in date. An Arabic origin of Chinese alchemy, on the other hand, although it has been suggested, seems very improbable, since a knowledge of alchemy did not reach the Arabs from Egypt until several centuries after we find alchemy well known in China. A common origin of Chinese and Arabic alchemy is quite possible.

Wei Po Yang was a Taoist philosopher, and the

development of alchemy in China was almost certainly closely connected with the later developments of Taoism⁴. He was born in the province of Kiangsu, and in the year 121 A.D. was summoned to the Court, but declined the invitation, having no liking for officialdom. He describes himself in the epilogue of the *Ts'an T'ung Ch'i* as "a lowly man who has no love for worldly power, glory, fame or gains", but content to spend his life in peace in a retreat in an unfrequented valley—definitely Taoist sentiments. His work is one of the Taoist classics, and is still read in China. It purports to be a commentary on the old Chinese classic, the *Book of Change*, but is really a treatise on the preparation of the elixir, or pill of immortality. Chinese works say Wei Po Yang and three disciples went to the mountains to prepare this, and when it was made he tried it on a dog, which died instantly. Wei Po Yang then asked what should be done, whereupon the disciples suggested that he should try it himself. He did so, saying that it would be a disgrace to live if the preparation of the medicine had failed through lack of concoction, and he also died instantly. One disciple then said: "Our teacher is no common person. He took the medicine and died of it. He must have done that with some special intention." He also took the medicine and died. The other two disciples then left to arrange for the burials, but when they had gone Wei Po Yang revived, and resuscitated the disciple and the dog with some of the well-concocted medicine; they all went the way of the immortals, leaving a note with a wood-cutter for the other two disciples.

Wei Po Yang's treatise has been translated by Dr. Lu-Ch'iang Wu and annotated by Prof. Tenney L. Davis⁵, the translation being preceded by an interesting general discussion. It states that the *Book of Change*, the Taoist doctrines and alchemy are merely three variations of the same thing under different names. It makes use of the early Chinese philosophical conceptions of the *Wu-hsing* (five elements: wood, earth, water, fire and metal) and *Yin-Yang* (two contrary principles). The words *yin* and *yang*, originally meaning dim or obscure, and bright, respectively, later took on the meanings of numerous pairs of opposites. Thus, *yang* meant the sun or male principle and *yin* the moon or female principle, the interaction of which produced the five elements, each identified with a planet. Dr. Wu and Prof. Davis point out that this doctrine of two contraries dominated

chemistry for a long period, and it may be suspected that it lingers in forms not mentioned by them even at the present day. Dr. Wu suggests, in opposition to generally received opinion, that the notion of *yin* and *yang* is not purely Chinese, that it came with the occult doctrines associated with it from some other civilisation, possibly from Babylonia or Egypt, and perhaps alchemy came with it at the same time. "But the search for the elixir of immortality seems to bear no necessary relation to the occult doctrine of the contraries, and we are unwilling to conclude that the two necessarily derive from the same origin." It is suggested that there is a clear and natural affinity between Chinese alchemy and Taoism: if alchemy did not originate out of Taoism, the latter at least "supplied a congenial medium for the growth of alchemical ideas". This theory has, in fact, seemed probable to a number of former investigators^{2,4}.

The translation of the *Ts'an T'ung Ch'i*, which Wu and Davis divide into sixty-nine chapters, shows that it is, as we should expect, an obscure and mystical work. It contains a number of subtle ideas and is enlivened by a sense of humour and an absence of egotism which contrast favourably with the writings of the Arabic and later European alchemists. Of positive chemical knowledge, such as we frequently find in the Greek alchemists³, there is very little, if any. An insistence upon secrecy is found.

As a specimen of the theoretical speculations in the *Ts'an T'ung Ch'i*, the following may suffice:

Chapter 18. "One, knowing the white, should hold firm to the black. For then divine light will come in due course. The white is the essence of gold and the black is the basis of water. The water is the control of the *Tao* and is one in number. At the beginning *yin-yang* is black, and with yellow sprouts, the master of the five metals and the river chariot of the north. Hence lead is black on the outside but holds gold flower in its bosom."

Those who are familiar with the Greek chemical texts will find many points of contact between the ideas in them and those of the above and many other passages in the Chinese text. The formation of litharge from lead is probably indicated.

As a specimen of the description of practical operations, the following may be quoted:

Chapter 64. "Above, cooking and distillation take place in the cauldron; below blazes the roaring flame. Before goes the White Tiger leading the way; following comes the Grey Dragon. The fluttering Scarlet Bird flies the five colours. Encountering ensnaring nets, it is helplessly and immovably pressed down and cries with pathos like a child after its mother. Willy-nilly it is put into the cauldron of hot fluid to the detriment of its feathers. Before half the time has passed,

Dragons appear with rapidity and in great number. The five dazzling colours change incessantly. Turbulently boils the fluid in the furnace. One after another they [the dragons?] appear to form an array as irregular as a dog's teeth. Stalagmites, which are like midwinter icicles, are spit out horizontally and vertically. Rocky heights of no apparent regularity make their appearance, supporting one another. When *yin* and *yang* are properly matched, tranquility prevails."

We have here a fairly clear account, as alchemical literature goes, of some process of solution and crystallisation.

Chapter 66. "White at first and then yellow, it finally becomes red on the outside and on the inside. This is called the first furnace and it is as large as a grain of millet. All this is the work of nature and has nothing to do with untoward doings. It is like the fact that the *ch'i* (ethereal essence) of the mountains and the waters rises to give clouds which then become rain. Again, it is like the reduction of mud to give dust and the destruction of fire to give earth. The bark of the *nieh* tree dyes yellow and the *lan* (indigo) dyes blue; the boiling of hides yields glue, and the *ch'ü nieh* yeast ferments to give liquor. It is easy to get results when the starting materials and the desired products are of the same kind. Otherwise it is very difficult."

Many points of contact between these and other statements in the Chinese treatise and in the Alexandrian Greek treatises can be found, so that the general conclusion of Dr. Wu and Prof. Davis, who do not favour much relation, is scarcely borne out by detailed examination: they cite, in fact, several parallels with Zosimos in the notes and could have cited a good number more. These notes suggest parallels with later works on European alchemy, and there is an index of (transliterated) Chinese words.

Dr. Wu and Prof. Davis are to publish later some alchemical chapters from Ko Hung, a celebrated Chinese Taoist philosopher and alchemist of the fourth century, and the history of chemistry will be enriched by their work. The translation of these early texts is a difficult task, from which previous sinologists have turned away in something like despair, but there is nothing like making a start. Criticism and improvement can follow this, but they do not precede it.

¹ Partington, "Origins and Development of Applied Chemistry", London: Longmans, Green and Co., Ltd., 1935, 23, 181.

² O. S. Johnson, "A Study of Chinese Alchemy", Shanghai, 1928. Wieger, "Taoisme", Hien Hien, 1911-13. W. A. P. Martin, "The Lore of Cathay", New York, 1901.

³ Berthelot, "Collection des Alchimistes Grecs", 3 vols., Paris, 1888. F. Sherwood Taylor, "A Survey of Greek Alchemy", *J. Hellenic Studies*, 50, 109-139; 1930.

⁴ Edkins, *Trans. China Branch Roy. Asiatic Soc.*, Hong Kong, 1855, pt. 5, 83-89; a valuable paper; cf. Partington, *NATURE*, 120, 158; 1927. Johnson, ref. 2, curiously omits to mention it.

⁵ Lu-Chi'ang Wu and T. L. Davis, *Isis*, 18, 210-289; 1932. Davis, *Scientific Monthly*, Sept. 1930.

Obituary

Mr. C. E. Stromeyer

HALF a century ago the practices used in the design and construction of industrial boilers left much to be desired in the way of scientific treatment, and it is no exaggeration to say that Charles Edmond Stromeyer, as chief engineer to the Manchester Steam Users' Association, was a leading spirit in the process of transforming the existing art into something approaching an exact science. The reason is not difficult to find, since he possessed an inborn capacity for investigation and research, to which was added the experience gained during seventeen years as an engineer surveyor to Lloyd's Register of Shipping. During that persistent endeavour, which occupied thirty years, the city of his adoption was a centre of interest for those engaged on the construction and maintenance of boilers, for engineers from distant lands frequently called upon him—and the pilgrimage continued after the year of retirement, in 1928. For this reason, a wide circle of friends must have welcomed the honorary degree of Dr. Ing. that was conferred last year by the Technische Hochschule at Aachen on its old graduate.

It is strange to recall that Stromeyer's apprenticeship was terminated due to an incapacity for further manual labour, since up to a few weeks before his death at Bad Nauheim, on July 23, in his eightieth year, he daily attacked the work that lay before him in the study and the laboratory. As a further indication of this unceasing activity of mind and body, it may be remarked that the manuscript of his "Unity in Nature", which may still be read with much pleasure and profit, was written *en route* during bi-weekly journeys between Manchester and London in the years preceding the War, when he was much occupied on professional and scientific affairs in London. Not the least important of those interests were matters connected with the foundation of the National Physical Laboratory.

Since he belonged to a generation that regarded education mainly as a training for independent thinking, Stromeyer's contributions to the proceedings of the Royal Society and our senior engineering and naval institutions almost invariably formed milestones by the way of progress in his sphere of interests. The ground included in that sphere was extensive, as he made the first direct determination of Poisson's ratio, used his interference strain indicator to measure the stresses on ships and the strains on railway bridges in the 'eighties, and contributed an instructive paper, on map-projection, to the International Geographical Congress held at Berlin in 1900. His work on the fatigue of metals is of outstanding merit, and the involved investigations doubtless gave rise to an original contribution presented in 1907 to the Manchester Literary and Philosophical Society, in which the atomic weights of the elements were expressed in the form of a harmonic series. In

view of such a wide and deep knowledge of natural philosophy, it is in the nature of things that his "Marine Boiler Management and Construction" should have attained a sixth edition, apart from foreign translations of the volume.

With his intense devotion to work, anything short of transparent honesty met with Stromeyer's strongest disapproval, and he considered no weapon too heavy to handle in the defence of what appeared to be the right course of conduct. That characteristic must have served him well during the War period, in undertaking the exacting duty of examining and reporting on the safety of secondhand boilers that would not have been used in other circumstances.

To those who were privileged to know him intimately, Stromeyer's cultured and attractive outlook on life was a constant source of pleasure, as the labour of the day never seemed to tire the boyish spirit that was the deep-seated source of his activity. The welfare of his assistants was as real a concern to him as was their success in professional affairs, and they, along with many others, will place him in that small company of whom it may be said that they were "Servants upon horses, and princes walking as servants upon the earth". In that role his charming wife bore him faithful company.

D. L-T.

 Dr. Arthur Bramley

THE death of Dr. Arthur Bramley on July 19 deprives chemical and metallurgical science of a brilliant worker. Born in 1878, he was forced to leave school early, and served a full apprenticeship to the hosiery trade. He commenced his technical education in Halifax Technical College, and in 1904 obtained a staff appointment there. This was followed in 1906 by a national scholarship of the Royal College of Science where he graduated, carried out research work and finally became private research assistant to Prof. J. C. Philip. With the latter he conducted a number of researches on the physico-chemical properties of solutions and ionic complexes the results of which are published in the *Journal of the Chemical Society*. He then proceeded to investigate the physical properties of binary liquid mixtures, for which work he was awarded the degree of D.Sc.

The second phase of Dr. Bramley's service to science commenced with his appointment to the technical staff of British Dyestuffs Corporation at Huddersfield, where he remained until he was appointed to take charge of the Department of Pure and Applied Science, Loughborough College, in 1918. At Loughborough he commenced a long series of researches on the diffusion of non-metallic elements into iron and steel and was able to show that the mechanism of this diffusion follows the normal physico-chemical course. These researches, published over a period of fifteen years, obtained for

him the award of the Carnegie Gold Medal in 1929.

Apart from his research work, Dr. Bramley was an enthusiastic teacher and had been instrumental in building up an active Pure Science Department in Loughborough College; his untimely end cut short a career which had promise of even greater fruition.

WE regret to announce the following deaths:

Dr. R. W. Brock, dean of the Faculty of Applied Science in the University of British Columbia, known

for his work in economic geology, on July 31, aged seventy-one years.

Prof. B. L. Robinson, emeritus professor of systematic botany in Harvard University, an authority on the classification of American spermatophytes, on July 27, aged seventy years.

Mr. W. T. H. Spicer, formerly first ophthalmic surgeon at St. Bartholomew's Hospital, known for his work in connexion with the teaching of ophthalmology, on August 8, aged seventy-four years.

Mr. A. H. Swinton, a well-known naturalist, author of "Insect Variety, its Propagation and Distribution", on July 25, aged ninety-one years.

News and Views

Archæology in the Cambridge Fens

IN another column of this issue of NATURE (see p. 304) there appears a brief account of the results of tree pollen and vegetation analyses of peat deposits in the Cambridgeshire Fens. The borings by which the material for these was obtained were made in connexion with an archaeological excavation undertaken with the object of establishing the stratigraphical position of prehistoric cultures of mesolithic and bronze age, of which surface indications appeared on this site at Peacock's Farm, Shippea Hill, Cambridge. The archaeological results, based on the stratigraphic evidence, taken in conjunction with the evidence of the botanical investigation, have a far-reaching significance. A succession of three cultural horizons has been established, Early Bronze Age, Neolithic and Late Tardenoisian. The demonstration of such a succession on one site in a single vertical section is unique. Further, the association of each with a definite forest growth and vegetation context—a microlithic industry is here found in a peat deposit for the first time in Britain—opens the way to a number of precise chronological and cultural correlations. Hereby this Late Tardenoisian site is linked up with other finds in Britain, such as that at Skipsea, Yorks, and with Continental sites, such as Maglemose, Mullerup and Kunda.

IN other directions, also, this excavation has established important criteria for future investigation. Thus Neolithic A, the Windmill Hill culture, appears in this part of the country for the first time, not far removed from sites of Neolithic B, "Peterborough", finds. The application of the method of pollen analysis to the latter, when occasion arises, no doubt at an early date, should settle definitely the, at present, uncertain chronological relations of the two cultures. Mr. J. G. D. Clark's skilful reconstruction of the history of the site—a history of shrinkage of the area of settlement from period to period owing to the encroachment of the peat, with long periods of inactivity intervening—is an achievement which will hold a permanent place in the history of archaeological investigation.

Excavations at Maiden Castle, Dorchester

EXCAVATIONS have been resumed at Maiden Castle, Dorchester, under the direction of Dr. R. E. Mortimer Wheeler, the initial objective being the investigation of the history of the ramparts. Digging at a point where the rampart rises to a height of fifty feet above the external ditch has revealed that the structure was composed of a core of carefully built up chalk rubble, faced on the inner side, covered with a layer of clay and chalk and surmounted by a parapet of limestone. The parapet was partially destroyed in ancient times, and eventually replaced by a timber palisade of which the socket holes have been found at a higher level. This palisade was constructed of stout timber posts at a distance of four or five feet apart and doubtless joined by woven hurdles. A cutting which has been made through the main defence shows evidence of five prehistoric periods in the history of the earthwork, the earliest being a palisaded bank of about ten feet, and culminating in an elaborate structure of masonry rising twenty feet above the internal camp. Beneath the original turf line a stone age factory floor was uncovered, on which were innumerable flakes from implement making, and a few scrapers and other tools. On an adjacent site a series of pits has been found, of which one is nine feet deep. These pits contained prehistoric pottery and a number of querns for grinding corn. Nearby was a group of ten loom-weights of chalk; and in the centre of this site post holes indicate the position of a large circular hut twenty-one feet in diameter. Finally, at the east gate of the camp three roads of late-Roman and post-Roman date have been examined and prehistoric road level has been reached.

Unknown Papua

SOME further particulars of the hitherto unknown people found in Papua by Mr. J. G. Hides (see NATURE, August 17, p. 251) are given in extracts from the official report and an article by the Australian correspondent of *The Times* in the issue of August 14. The report stresses the interest of the people in afforestation, the exactness of the division of the

fields for cultivation into squares and the straightness of the field drains, ranging from eight to ten feet in depth, the mode of burial in the open in wooden coffins surrounded by a picket fence, and the non-Papuan character of the people, shown especially in the lightness of their colour, their high cheekbones and finely moulded features. It is stated that, while anthropologists hesitate to express any opinion, owing to the lack of confirmation on investigation of previously reported marvels from the interior of Papua, Mr. E. W. P. Chinnery, Government anthropologist of Papua, has suggested their identity with the unknown tribes of Mount Hagen discovered in 1932 by Messrs. J. L. Taylor and M. Leahy (see *NATURE*, 134, 328; 1934). Mr. Hides, however, maintains that he has discovered a new people, but identifies tribes whom he afterwards encountered to the south-east with the people of Mount Hagen. His own theory is that the light-skinned people escaped years ago up the limestone cliffs after defeat in battle by other tribes and, discovering this fertile valley, settled, multiplied, and developed an entirely self-contained community. Until photographs are available, no judgment is possible, and until much more is known of the physical characters of the inhabitants of Papua, there is little utility in the discussion of theories of the survival of races. In the meantime Mr. Leahy and his brother confidently claim priority of discovery, and assert that light-skinned natives, common to many tribes, are pathological cases and usually exhibit symptoms of a mild form of St. Vitus's dance. Mr. M. Leahy, it is reported, is now on his way to submit photographs, films and other data to the Royal Geographical Society.

The Ovada Disaster

ONE of those calamitous occurrences which, from time to time, show the fallibility of human judgment in constructional work, has plunged northern Italy into desolation and mourning. Shortly after noon on August 13, a dam, which formed in the valley of the River Orba in Piedmont near the town of Ovada, the artificial lake, or reservoir, of Orsiglieto, containing a volume of 78,000,000 cubic feet of water, suddenly gave way and the impounded water, thus released, swept through the valley, destroying entire villages and causing widespread havoc and destruction. The number of lives lost is probably several hundred, and has been put so high as a thousand; but, in the absence of official statement, this estimate should, perhaps, be accepted with reserve. Four bridges were broken, one of them a railway bridge which collapsed a few minutes after a passenger train had passed over it. Nearly two miles of track has been torn up. The other three bridges were highway structures. Traffic was cut off, and telephonic and telegraphic communications interrupted. The flooded zone extended over an area about $2\frac{1}{2}$ miles long and $1\frac{1}{2}$ miles wide. It is stated that the disaster was the culmination of a series of violent thunderstorms which broke over southern Piedmont and central Liguria during the night of August 12 and the morning of August 13, and that in the Ovada region,

adjacent to the dam, the precipitation reached the intensity of a 'cloudburst', converting streams and watercourses into raging torrents. The damage is roughly estimated in the neighbourhood of a million sterling. The dam, which is part of the undertaking of the Genoa Electrical Co., was built twenty years ago. Official instructions have been issued for its reconstruction.

Sir John Colbatch

UNDER the title of "An Early Forgotten Anti-septic Surgeon", who, as he maintains, has been most unjustifiably neglected by surgeons and medical historians, Prof. D. F. Fraser-Harris (*Med. Press and Circ.*, June 19, pp. 580-82) gives an account of John Colbatch, the author of a work published in 1704 entitled "Novum lumen chirurgicum or a New Light of Surgery wherein is Discovered a much more Safe and Speedy way of Curing Wounds than has hitherto been Practised". In this book, Colbatch describes the virtues of a "vulnerary powder", with which he had dressed wounds so successfully that in about four days all putrefaction was stopped. The composition of the powder he kept secret, and thereby incurred the reputation of a quack; but his comparison of its odour to the smell of roses suggested to Sir Watson Cheyne that it was ammonium salicylate. The chief scientific interest of Colbatch's work lies in the fact that, in addition to relating in detail the histories of fourteen cases of severe wounds in Flanders, where he was on military service, treated by the powder, he states that he performed experiments on about a hundred dogs to test its value, and was thus one of the earliest surgeons to experiment in the modern sense of the term. The date of Colbatch's birth is uncertain, but he died at an advanced age on January 15, 1729. He was knighted by George I in 1716.

Work of the Mellon Institute

THE twenty-second annual report of the Mellon Institute of Industrial Research, covering the period 1934-35, refers to extending activities in scientific, as well as in industrial, research. It is expected that the new building will be gradually occupied during 1935 and be complete by the end of the year. 62 industrial fellowships were in operation during 1934, requiring the services of 97 fellows and 48 assistants. 56 of these fellowships were in operation at the end of the year, and a high proportion of the fellowships are of five or more years standing. New fellowships during the year dealt with starch, stone, dried yeast, soya bean, etc., while fellowships terminated during the year covered cleaning, sugar, velvet, phosphates, paper finishing and vanadium. Special attention is directed to the studies on cinchona alkaloids conducted by the Department of Research in Pure Chemistry with the object of discovering compounds of therapeutic value in pneumonia. Fifty-nine such preparations have been tested, and biological and clinical data are being accumulated, some of which have been published. Studies on the preparation of apoquinine and its ethyl and hydroxyethyl ether are

practically ready for publication. A research on the action of sodium and sodamide has been completed and the preparation and alkylation of cinchona alkaloid oxides is being studied.

On the industrial side, important results have been obtained in fundamental research on carbon blacks. These have led to the development of a method for the colloidal dispersion of carbon black pigments in lacquer vehicles, which gives black lacquers of markedly improved properties. Other fellowship studies have shown that, by the use of aqueous dispersions of carbon black, maximum darkening of concrete can be obtained with a minimum (2 per cent) of pigment, with as much as 25 per cent greater strength in the concrete. Aqueous dispersions of carbon black for these purposes are being sold under the name 'Hiblak'. Other researches have led to the development of a new enamelling process, new building materials, including improved plastic cements and new sulphur cements for use as binding agents or protective coatings in structures subjected to acids or corrosive solutions. New methods for testing refractories have been developed while the fundamental investigations on sodium hexameta-phosphate which have led to the development of 'Calgon' have been continued. Under a fellowship for organic synthesis, methods for the preparation of glycol ethers have been developed and improved, new types of vinyl resins examined, and a group of polyethylenamine derivatives of ethylenediamine has been developed for use in gas purification. New uses for ethylene and morpholine amines have been discovered, and important work on dental caries and on atmospheric pollution has also been carried out.

President Masaryk and Technology

UNDER the title "T. G. Masaryk a Technika" the Masaryk Academy of Work has published an account of President Masaryk's contacts with science and his keen interest in the technical applications of pure science. It will be recalled that his early experiences at the blacksmith's forge proved of value to him in after life when he was professor of philosophy and later still in his capacity as President of the Czechoslovak Republic. Quite early in his university career, he drew up a classification of the sciences (afterwards much used and adapted on the Continent), dividing them into theoretical (abstract and concrete) and practical. He placed them into seven groups, showing their mergings and affinities. Without being a specialist in any branch, Prof. Masaryk was well versed in scientific method and became something of an expert in detecting forgeries. He endeavoured to direct his philosophy and science towards improving the amenities of mankind. Two quotations from his writings make clear his attitude. "In former times we went after things which struck our fancy, we went in search of gold, the philosophers' stone, the elixir of life. Now we analyse water, air, the soil, manure, everything ordinary that surrounds us." "Without work we shall never have sufficient self-confidence. Work alone shows us what we are

capable of. Work is self-recognition." The main part of the publication "T. G. Masaryk a Technika" has been compiled by Dr. V. Škrach; but a section on the origin of the Masaryk Academy of Work in 1920 is contributed by Prof. E. Zimmler, a former chairman. The Academy was founded as an autonomous scientific institution to organise technical work, making the best use of scientific advances and the natural resources of Czechoslovakia. It is composed of six sections: biological science and medicine, agriculture and forestry, building science, mechanics and electro-technics, chemistry and national economy. In its programme the Academy has combined all branches of engineering with the sciences, and has attempted to correlate research work and advances in the different sections so that they can be put to technical applications with the least possible delay.

Longer Trade Cycles

In a pamphlet entitled "The Longer Trade Cycles" (Almquist and Wiksells Boktryckeri A.-B., Stockholm, 1935), Axel F. Enström claims that a sixty year oscillation can be traced in a large number of price movements and production processes. An investigation of coal price quotations is said to have shown a complete sixty year period extending from about 1850 to 1910, while an examination of Sauerbeck's index number curve for wholesale prices disclosed the same cycle and in addition pointed to an earlier cycle of probably the same length. Valuable data illustrating price variations over a very long period, going back as far as the thirteenth century, are to be found in the Vicomte D'Avenal's monumental survey of French wheat prices, and an analysis of this material, according to Mr. Enström, shows a series of cycles of the order of magnitude of 60-50 years. If the D'Avenal curve is examined in the light of purely qualitative evidence which French, Swedish and European history as a whole can give regarding economic events in the eighteenth and nineteenth centuries, it will be found that the 60-50 year period of the curve accurately reflects the fluctuations in the European trade situation. The great technical inventions have as a rule been achieved in those periods which correspond to periods of depression in the superposed trade curve, that is, in periods characterised by a low price level.

Recent Developments in Genetics

THE Nobel lecture given by Prof. T. H. Morgan at Stockholm on June 4, 1934, is printed in the *Scientific Monthly* of July 1935. In it Prof. Morgan reviews the progress of genetics, with special emphasis on recent developments. The nature of the gene is discussed, the position each occupies in the chromosome being regarded as probably in the nature of a historical accident. Linkage, translocation, the pairing of chromosome threads and the recent work on salivary gland chromosomes all yield evidence regarding the nature of the genes, but the manner of their growth and division remains hidden. The physiological properties of the genes and their

relation to development are discussed at length. That embryological differentiation is not a sorting out of genes is clear, but present evidence is insufficient for deciding between various possible views of the ways in which the genes control development. (1) All genes may be active all the time, producing different results by their action on different parts of the egg cytoplasm. (2) Different batteries of genes may come into action at different stages of development, or at different rates, as Goldschmidt has postulated for sex-genes. (3) Possibly the kind of activity of the genes changes in response to the kind of protoplasm in which they lie. Finally, the relation of genetics to medicine is touched upon, and the importance of the developments in human genetics is recognised in relation to the inheritance of human defects, mental and physical. It is predicted that hundreds of cases of genetic linkage in man will be discovered.

Teaching the Value of Forests

ONE of the troubles in connexion with forestry and afforestation in Great Britain is the loss by the population of what, for want of a better term, has been termed the 'forestry sense'. Out in the Empire the difficulties of the forest officer arise from other causes. In each case it is sought by propaganda and education to teach the people the true value of the forest and its position in the economic structure of nations and the lives of the population. The Forestry Department in Trinidad is issuing a series of Forestry pamphlets "for teachers". No. 3 of the issue (Trinidad: Government Printer, Port-of-Spain, 1934) is entitled "Timber: Its Structure, Properties, Seasoning and Preservation" by Mr. R. L. Brooks, the conservator of forests. The pamphlet is illustrated by simple diagrams.

OF a somewhat different type, but having the same object in view, is the handbook to a temporary exhibition (May-September) based on the tree collections in the Department of Botany in the National Museum of Wales. This small brochure is entitled "Some Aspects of Forestry in Wales" (Cardiff 1935). The handbook has been prepared by Mr. H. A. Hydes. In a preface, Dr. Cyril Fox, the director of the Museum, writes: "The Forestry Act of 1919 authorised the formation of large State Forests and has thus broadened immeasurably the basis of forest ownership. Every man is now an owner of plantations, and should have some idea of how and why they are created and maintained. Such problems as the relative values of broad-leaved trees and coniferous trees as forest crops, and the scenic effect of planting introduced species along with native trees, which are now freely discussed in the Press, can only be understood in the light of at least a minimum of knowledge of the species concerned and of their relation to forestry in general." The exhibits are set out under the headings: Welsh forest botany, forest operations, forest pathology, wood anatomy and utilisation of forest produce. Among interesting exhibits are those relating to the beautiful woods of the Wye Valley, afforestation of sand dunes in South Wales, and the well-known plantations at

Lake Vyrnwy, the chief reservoir for supplying water to the city of Liverpool. Those plantations now amount to 4,500 acres out of the total area of 5,000 acres which it is proposed to plant.

Literature of the Occult

ALTHOUGH the consideration of magic is a necessary prelude to the study of primitive religion, and, as such, lays claim to no inconsiderable share in the literature of anthropological science, it forms relatively only a small proportion of the vast accumulation of printed matter which has grown up in relation to magic in the larger sense, more especially in connexion with its manifestations in belief, theory and practice in medieval and modern times. Excepting historical and descriptive treatment, scientific analysis of this mass of material has barely begun. Eventually, when its evidence has been sifted and subjected to test, it should provide a valuable corpus of reference in the scientific investigation of manifestations of the 'marvellous'. In the meantime, a comprehensive library of occult literature is indispensable to research, especially in the detection of fraud. Unfortunately, the works which contain contemporary or early records of the facts are often both rare and costly. The University of London Council for Psychical Investigation is fortunate in having at its disposal the library of occult literature formed by Mr. Harry Price, from which a selection of five hundred rarities was on exhibition in December last (see *NATURE*, Dec. 15, 1934, p. 927). In 1929 Mr. Price published a catalogue of the greater part of his library, which contained 10,000 items. To this he has now added a supplement containing an additional 2,500 items acquired since that date (University of London Council for Psychical Investigation, Bull. 1: "Short-Title Catalogue of Works on Psychical Research . . . : From 1472 A.D. to the Present Day", pp. 112. London: 13D Roland Gardens. 2s. 6d.). It is embellished with nine illustrations, title-pages or cuts from rarer books such as Molitor's "De Lamiis et Pythonicis Mulieribus" (c. 1489) or "The Famous History of Friar Bacon" (1660), "very pleasant and delightful to be read" as is recorded on the title-page.

Power Farming in India

THE Imperial Council of Agricultural Research in India has issued, as Scientific Monograph No. 9, a report by C. P. G. Wade, on mechanical cultivation in India, prefaced by an approving foreword and an introduction, written by agricultural officers of the Government. The publication of the report in this form is of special interest, for the work has been inspired, financed and largely carried out by a commercial organisation, the Burmah-Shell Oil Storage and Distributing Co. It is difficult to see how the Government could have given official approval to work of this nature without raising awkward questions of precedent and policy, but for the existence of the Council, the constitution of which, as drawn up by the Linlithgow Commission on Indian Agriculture, was kept flexible and free from

certain restrictions necessarily observed by Government departments. Much of the work was done co-operatively with the agricultural departments of Provincial Governments. The scheme of work was conceived on broad and public-spirited lines; the Company cannot hope to recover its expenditure by any immediate increase in sales of oil; the most it can expect is to share, in common with other industries, in the increased general prosperity that will accompany any lasting improvement in the agricultural conditions of rural India. Although the greater proportion of Indian cultivators farm under peasant conditions, and cannot directly take up power farming, the question of co-operative use is worthy of attention; in addition, there seems a much larger scope for heavy power machinery on large holdings, for example, planters' estates, and in the reclamation and improvement, under Government supervision, of large areas. The report deals in detail with an extensive series of experiments on weed eradication by deep cultivation, on contract ploughing and on the analysis of costing data. The concluding chapters are devoted to a discussion of the design and performance of tractors and cultivation implements in relation to Indian conditions, and to the organisation of contract tractor ploughing.

Annual Report of Cheshunt Experimental Station

THE twentieth Annual Report (1934) of the Experimental and Research Station of the Nursery and Market Garden Industries Development Society, Ltd., has recently been published, from the Station, Turner's Hill, Cheshunt, Herts (pp. 107). The experimental work for 1934 is a continuation of the previous trials of varieties, fertilisers, soil heating, methods of sterilisation and other practices. Mycological investigations include a considerable section on virus diseases, and studies of fungi which attack chrysanthemums, roses, lettuce, carnations and other crops. A new insect parasite of the tomato moth caterpillar has been further described, pests of lettuce and chrysanthemum have received special study, whilst the more common thrips, symphilitis and woodlice have also had attention. Insecticide and fungicide investigations have been continued, and the chemists have inquired into the potash content of 'blotchy' tomatoes and the manurial nutrition of chrysanthemums. The effects of light and water content on the growth of tomato plants, with studies on vernalisation, form the main subjects of physiological interest.

Use of Radium in Ireland

THE Irish Radium Committee has issued its report for the year 1934 (*Sci. Proc. Roy. Dublin Soc.*, 21, No. 25, 1935. Separate issue). There was a small increase in the number of batches of radon tubes issued; but a decrease in the total quantity of radon, owing to the continued tendency towards the use of smaller doses, and a considerable increase in the number of cases treated. Little can be gathered from the report of the success or otherwise of the treatment, and an unsatisfactory feature is the

fact that some 25 per cent of the patients treated could not be traced after their discharge from hospital.

Prof. P. O. Pedersen

THE friends of Prof. P. O. Pedersen, principal and professor of electrotechnics of the Royal Technical College, Copenhagen, have published in English some of his papers written in Danish to commemorate his sixtieth birthday, which occurred on June 19, 1934. The subjects discussed are mainly on the development of electrical communication technique, with special reference to contributions by Danes. Excellent work has been done by Gulstad, L. Lorenz, Jensen, C. E. Krarup, Johnsen and Rahbek, Valdemar Poulsen and Prof. Størmer. In a lecture delivered in 1933, Pedersen discusses the possibility of an application of scientific technical methods to other fields of research. The last paper given is on the depreciation of public utilities. In an appendix, a list is given of 97 publications by Pedersen.

New Discoveries of Permian Insect Fossils

ACCORDING to Science Service, Washington, D.C., an extensive deposit of fossil insects has been brought to light in a sandstone stratum near the mouth of the Mezer River on the Arctic coast of the U.S.S.R. A preliminary study of these remains has been made by Prof. A. G. Martynov, who finds that all Palaeozoic families of insects are represented. Cockroaches are most abundant, but grasshoppers, dragonflies, scorpion flies and other primitive insect groups are also well represented, together with a small number of Coleoptera. An expedition of the Russian Academy of Sciences is at present making collections and studies in the region mentioned. It appears that these insect beds are contemporaneous with the well-known insect-bearing strata of Kansas, which have yielded an abundant fauna.

Japanese Biological Publications

WE have received vol. 3, Nos. 1 and 2 of *Botany and Zoology, Theoretical and Applied*, from Japan. It is a monthly publication, and these two numbers contain 364 and 176 pages respectively. The papers are illustrated and cover every phase of biology, but with the exception of one paper by Prof. Crozier, of Harvard University, they are entirely in Japanese. Only the scientific names and the names of Western authors are given in European characters, except one paper printed in Japanese using the Western alphabet! It seems a pity that papers, many of which are evidently of considerable general interest, should thus be cut off from Western science. Even Esperanto, which is occasionally being used by the Japanese in their scientific publications, would be preferable as a medium of publication if it is intended to attract the interest of biologists outside Japan.

Scientific Research in Australia

THE eighth annual report of the Commonwealth of Australia Council for Scientific and Industrial Research shows an increasing range of investigation and a growing number of requests for assistance

and advice. The difficulties which the Council had to face in its early years have now been largely overcome, and research stations have been provided and staffed, and are in full activity. The range of problems covers plants, insects, animal nutrition, soil, irrigation, forest and cold storage problems, all of which are important to Australian prosperity. The fear that activity would have to be curtailed owing to financial stringency necessitating a reduction in the Council's grant has been largely obviated by the readiness with which funds have been given by corporations, commercial companies and private persons.

Bibliography of Greenland

A BIBLIOGRAPHY of works on Greenland confined to authors born in Norway, as well as Icelandic authors prior to 1814, has been compiled by Mr. H. Vartdal and published as No. 54 of the *Skifter om Svalbard og Ishavet*. The list runs to nearly eight hundred entries, and subsequent to 1721 is arranged according to subjects. A full index facilitates use. The list certainly has value, but would have been far more useful if it had been compiled without reference to the nationality of the authors, since the greater part of the works on Greenland are by Danish writers.

Bibliography of Seismology

MR. ERNEST TILLOTSON, 23, Roseville Road, Leeds, 8, writes with reference to notes on this subject in *NATURE* of June 29, p. 1070, and July 27, p. 138, that he has received from Mr. Ernest A. Hodgson, the author of the "Bibliography of Seismology", a number of forms to fill in with details of British publications on seismological subjects. With the aid of these forms, he hopes to keep the "Bibliography" as up to date as possible so far as authors normally resident in the British Isles are concerned. To this end Mr. Tillotson asks such authors to send to him at the above address any newly published seismological literature. It is probable that, whilst papers and books on seismology in the narrower sense have been included in the "Bibliography" already, papers on seismological prospecting or on such subjects as changes in level, or the growth of faults, or earthquake insurance, etc., may have been overlooked.

International Navigation Congress

THE sixteenth International Navigation Congress, which is to be held at Brussels on September 2-13, under the patronage of H.M. the King of the Belgians and the presidency of the Minister of Public Works, will discuss a number of questions and communications relating to inland and maritime navigation, including the regulation and treatment of rivers and canals and the protective works required at ports and harbours. The Belgian Government has invited all the States interested in the Association of International Navigation Congresses to send official delegations to Brussels for the occasion. The Secretary General of the Association is M. Joseph Millecam,

38 rue de Louvain, Brussels, from whom full particulars can be obtained of the meetings, and of the excursions to various installations and undertakings in Belgium and Holland.

Announcements

THE National Trust has accepted an offer by the Countess Buxton of nearly 150 acres of the South Downs at Newtimber Hill. The gift includes down and mixed woodland (mainly beech) with exceptionally fine views to the north and west, including Chanctonbury and Cissbury Rings.

THE fifteenth International Congress of Medical Hydrology, Climatology and Geology will be held at Belgrade in October 1936 under the patronage of the Prince Regent. Further information can be obtained from the general secretary, Prof. M. Neskovitch, 3 rue Takowska, Belgrade.

THE second International Congress of Mental Hygiene will be held in Paris on July 27-31, 1936, with Prof. H. Claude as president of honour and Dr. E. Toulouse as president. The official languages will be French, English, German, Italian, Spanish and Portuguese. Typewritten copies of communications must be sent to the president of the executive committee, Dr. René Charpentier, 119 rue Peronnet, Neuilly-sur-Seine, France, not later than November 1, 1935. The subscription, which is 125 francs, should be sent to the treasurer, M. R. Demaelus, 27 rue de Londres, Paris.

THE first number of a new quarterly, *Annals of Science*, devoted to the history of science since Renaissance times, will be published by Messrs. Taylor and Francis, Red Lion Court, E.C.4, on January 15, 1936 under the editorship of Dr. D. McKie of University College, London, joint author of "The Discovery of Specific and Latent Heats"; Prof. Harcourt Brown, of Washington University, St. Louis, U.S.A., author of "Scientific Organisations in 17th Century France"; and Mr. H. W. Robinson, assistant librarian of the Royal Society of London, co-editor of "The Diary of Robert Hooke".

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

A junior scientific officer (physicist) at the Fuel Research Station, East Greenwich—The Establishment Officer, Department of Scientific and Industrial Research, 16, Old Queen Street, Westminster, S.W.1 (Aug. 27).

A research chemist in the Department of Agriculture, Straits Settlements and the Federated Malay States—The Director of Recruitment (Colonial Service), 2 Richmond Terrace, Whitehall, S.W.1. (Aug. 31).

A lecturer in the Civil and Mechanical Engineering Department of the Woolwich Polytechnic, S.E.18—The Secretary (Aug. 31).

An assistant lecturer in agriculture to the Cornwall County Council Education Committee—The Secretary, Education Department, County Hall, Truro (Sept. 10).

Letters to the Editor

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

NOTES ON POINTS IN SOME OF THIS WEEK'S LETTERS APPEAR ON P. 303.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

Statistical Tests

As the originator of the P, χ^2 test, I should be glad if you can spare me space for some reply to Mr. Buchanan-Wollaston¹. I should like first to state that I am in no way responsible for all the applications which have recently been made of that test, and do not accept the validity of some of the applications which Prof. R. A. Fisher has made of it in his well-known textbook. I am not concerned with his position and leave him to defend it. My own position is as follows:

(i) I introduced the P, χ^2 test to enable a scientific worker to ascertain whether a curve by which he was graduating observations was a reasonable 'fit'. On this account, and as a measure of success in graduation, I termed it a 'goodness of fit' test. It had no special relation to the normal curve or to any other curve. The scientific worker in the past had chosen any curve he pleased to graduate his observations, but he rarely applied any measure of its aptness, beyond looking at a graph to 'see' whether it was a 'good fit'. The pages of the Royal Society *Transactions* and *Proceedings* are evidence enough of this fact.

(ii) As a measure of 'goodness of fit', the P, χ^2 test does enable one to compare the relative advantages of any two graduation curves. But I personally have never assumed that the better graduation curve was the one from which the material had actually been drawn.

(iii) I have shown both theoretically and experimentally that there is a high correlation between the 'goodness of fit' of a graduating curve to a *sample*, and the 'goodness of fit' of that curve to the parental population from which the sample has been drawn. Accordingly, *if the sample be large*, the graduating curve may be taken as representing reasonably the parent population.

(iv) I have shown that, when dealing with *small* samples, no real distinction can be made between sampling from, say, a normal curve or a rectangle. It requires at least a sample of more than a 100 individuals to determine whether it would be best to use a rectangle or some other curve! I have repeatedly insisted that little can be learnt of the superiority of one graduating curve over another, if the sample be not of considerable size, say, well beyond the 100 mark.

All this proves that the P, χ^2 test has no relation to Mr. Buchanan-Wollaston's remark that: "The fact that British methods 'work' is due to the prevalence in Nature of distributions *similar* to the Gaussian [*sic*] rather than to any peculiar virtue in the methods themselves". It would appear from this remark that my critic and his 'Continental workers' have never gone beyond applying the test to questioning whether the normal curve was a reasonable graduation curve!

(v) The only relation of the P, χ^2 test to the normal curve arises from the use of that curve in

the analysis to replace binomials by normal curves. Such replacement is not legitimate *theoretically*, when in the binomial $(p + q)^n$, p is very much larger or very much smaller than q . This has led to the practice of clubbing together small 'tail' groups. But practically there is, *as a rule*, very small difference in the resultant P 's, whether we club tail groups and reduce the number of cells, or work P out for the full number after considering outlying individuals which may be anomalous. I do not therefore understand Mr. Buchanan-Wollaston's remark that: "It seems only reasonable that but a small part of the centre of the χ^2 distribution should be used as a test of fit". In a large percentage of cases to which χ^2 may be applied in biometric and biological investigations, there are no 'tails', that is, no small categories at the terminals. If we wish to avoid the assumption that at such 'tails', where they exist, it is legitimate to replace binomials by normal curves, then the P, λ_n test can be applied.

(vi) From my point of view, the tests are used to ascertain whether a reasonable graduation curve has been achieved, not to assert whether one or another hypothesis is true or false. If we narrow ourselves down to asking whether a normal curve will reasonably graduate the material and find it does, are we to follow it up by asserting that either sample or parent-population follows a normal distribution? I should say: Certainly *not*. I have never found a normal curve fit anything if there are enough observations! The astronomical data provided to prove that errors of observation follow normal curves are pitifully scanty, and if proper tests are applied usually show that they do not! The fact is that all these descriptions by mathematical curves in no case represent 'natural laws'. They have nothing in this sense to do with 'hypothesis' or 'reverse of hypothesis'. They are merely graduation curves, mathematical constructs to describe more or less accurately what we have observed.

(vii) The reader will ask: "But if they do not represent laws of Nature, what is the value of graduation curves?" He might as well ask what is the value of scientific investigation! A good graduation curve—that is, one with an acceptable probability—is the only form of 'natural law', which the scientific worker, be he astronomer, physicist or statistician, can construct. Nothing prevents its being replaced by a better graduation; and ever better graduation is the history of science.

What is the use of good graduation curves? Ask the actuary! Such curves enable a mass of details to be summed up with reasonable probability in the knowledge of a few constants, and from those constants we obtain new knowledge of the properties of the mass. Take only the importance of a life table graduated by the Makeham-Gompertz curve and consider, what new knowledge flows from it. But

after all, it is only a graduation curve and it is open to anyone to find a better one! If Continental statisticians in the bulk do indeed hold the views of Mr. Buchanan-Wollaston, it can only be that they have not really studied and grasped the fundamental literature of the subject.

KARL PEARSON.

Biometrika Office,
University College,
London.

¹ NATURE, 136, 182, August 3, 1935.

Blood Group Inheritance

SEVERAL theories of the inheritance of human blood groups have been proposed, but none has been completely satisfactory.

(i) The theory of two independent pairs of Mendelian factors, proposed by Hirschfeld and von Dungern¹, leads to the equilibrium condition

$$ps = qr$$

where p, q, r, s are the frequencies of the groups AB, A, B, O . But^{2,5} in all observations of the distribution of the groups,

$$ps < qr.$$

(ii) The corresponding condition arising from Bernstein's multiple allelomorph theory^{3,5} is

$$\sqrt{q+s} + \sqrt{r+s} = \sqrt{s} + \sqrt{p+q+r+s}.$$

This is satisfied with sufficient accuracy in all observed distributions, but this theory fails to account for the observed occurrence of a small percentage of groups AB and O in the offspring of $AB \times O$ matings.

(iii) Bauer⁴ proposed to account for this by the mechanism of 'crossing-over'. His theory is the subject of criticisms in a paper now in course of preparation, in which we shall show that the following theory, which is not exactly what Bauer stated, is the one to which his premises should have led:

(iv) The blood groups are inherited in association with two linked pairs of Mendelian factors, A, a, B, b . There are thus four kinds of gametes,

$$AB, Ab, aB, ab;$$

and ten genotypes:

$AB.AB, AB.Ab, AB.aB, AB.ab, Ab.aB$ —phenotypically group AB ;
 $Ab.Ab, Ab.ab$ —group A ;
 $aB.aB, aB.ab$ —group B ;
 $ab.ab$ —group O .

If crossing-over takes place, we may suppose that there is a certain probability ω that the genotype $AB.ab$ transmits the gametes Ab and aB normally transmitted by the genotype $Ab.aB$; and the same probability of vice versa.

In Bauer's theory (iii), ω is about 0.055. If $\omega = 0$ and the first four genotypes in the above scheme are initially (and therefore permanently) absent from the population, the theory (iv) reduces to (ii). With $\omega = \frac{1}{2}$, (iv) is indistinguishable from (i).

The theory we actually propose is (iv) with $\omega = 0$. (This also gives results indistinguishable from (i) in all matings which do not involve the distinction between the genotypes $AB.ab$ and $Ab.aB$.) It is unnecessary to postulate crossing-over, since with this theory $AB \times O$ matings would anyhow give rise to some AB and O offspring. But, further, crossing-over is definitely precluded, since it may be shown to lead to the same equilibrium condition as the

theory (i). There is no corresponding condition when $\omega = 0$; that is to say, any distribution of the groups can be in stable equilibrium provided that the genotypes are suitably distributed. But for equilibrium distributions in which AB is rare compared with the other groups, the theory approximately coincides with (ii); and therefore, as in that theory,

$$\sqrt{q+s} + \sqrt{r+s} = \sqrt{s} + \sqrt{p+q+r+s}$$

approximately. This, as already pointed out, agrees with observation, and therefore (since p is generally about 5 per cent) corroborates the new theory.

The rare recorded occurrences⁵ of A offspring from $O \times O$ matings, of AB and B from $A \times O$, and of AB and A from $B \times O$, cannot be accounted for genetically by any of these theories. They must still be put down to mistaken parentage or faulty technique in group determination.

Thus the theory proposed has all the advantages of its predecessors, with fewer disadvantages.

J. FFOULKES EDWARDS.

University College Hospital,
London.

I. M. H. ETHERINGTON.

Department of Mathematics,
The University,
Edinburgh.
July 6.

¹ Hirschfeld and von Dungern, *Z. Immun. Exp. Therapie*, 6, 284; 1910.

² Lattes, "The Individuality of the Blood". O.U.P. (1932).

³ Bernstein, *Z. Ind. Abst. u. Vererb.*, 37, 237; 1925.

⁴ Bauer, *Klin. Wochenschr.*, 7, 1588; 1928.

⁵ Furuhashi, *Japan. Medical World*, 7, No. 7, 1927.

Technique of Factor Analysis

FACTOR analysis is a subject upon which Prof. G. H. Thomson, Dr. Wm. Brown and others have frequently written letters to NATURE. This analysis is concerned with a selected population of n individuals each of whom has been measured in m tests. The $(m)(m-1)/2$ intercorrelations for these m variables are subjected to either a Spearman or other factor analysis.

The technique, however, can also be inverted. We begin with a population of n different tests (or essays, pictures, traits or other measurable material), each of which is measured or scored by m individuals. The $(m)(m-1)/2$ intercorrelations are then factorised in the usual way.

This inversion has interesting practical applications. It brings the factor technique from group and field work into the laboratory, and reaches into spheres of work hitherto untouched or not amenable to factorisation. It is especially valuable in experimental aesthetics and in educational psychology, no less than in pure psychology.

It allows a completely new series of studies to be made on the Spearman 'central intellective factor' (g), and also allows tests to be made of the Two Factor Theorem under greatly improved experimental conditions. Data on these and other points are to be published in due course in the *British Journal of Psychology*.

W. STEPHENSON.

Psychological Laboratory,
University College,
Gower Street,
London, W.C.1.
June 28.

Rainfall-Evaporation Ratio in Relation to Locust and Grasshopper Outbreaks

A WIDESPREAD outbreak of the migrating grasshopper, *Chortocetes terminifera*, Walk., occurred in Australia during 1933-35. Reports show that, in South Australia, small, local swarms appeared during the summer 1932-33 in certain districts in the pastoral country about 150 miles north of the 10 in. annual isohyet (see Fig. 1). During 1933-34 swarms were widely distributed and in some areas extended about 100 miles south of this rainfall line. During 1934-35 they became generally distributed southwards over the agricultural areas of the State.

The southern portion of the State includes the better rainfall agricultural areas. Precipitation is more reliable and most of the rain falls during the winter period (May-October), the summer being hot and dry.

Ch. terminifera lays its eggs in particular soils to a depth of about 2 in. Dryness of the soil results in an enforced diapause in the egg stage, but experimental data are not yet available for this species: Faure¹ showed with *Locustana pardalina*, Walk., in South Africa, that the eggs remained viable in dry soil for 37 months. Soil moisture is determined primarily by rainfall in relation to evaporation (R/E). I have already shown how mean monthly values for the ratio R/E may be computed for Australia². In the accompanying map of South Australia (Fig. 1), the months and approximate areas are shown in which the mean monthly values for R/E are 0.5 or more. It is considered tentatively that these values, in South Australia, give adequate soil moisture for the development of the eggs of *Ch. terminifera* provided temperature is suitable. It may be noted that, in countries where data for evaporation are not available, the ratio of precipitation to atmospheric saturation deficit may be used as an index of aridity; this ratio was originally employed by Meyer in 1926 (vide Prescott³, 1934).

The mean monthly temperature for the coldest month (July) over the greater part of South Australia does not fall below 50° F.; over the elevated districts of the agricultural areas, it varies between 45° and 50° F. The temperature value for the developmental zero of the eggs of *Ch. terminifera* has not yet been determined. It is evident, however, that in South Australia temperatures will not be below this value for long periods. Eggs laid in summer, in the southern portion of the State, will hatch in autumn or early winter, particularly if the wet season opens early; this period is unfavourable for the insects, and mortality is heavy; this was the

case in the autumn of 1935. When the wet season opens late, the insects hatch out nearer to the spring months, particularly in the northern hatched areas shown on the map; this was the case in 1934, and the survival rate of the insects in the spring was high. The favourableness of the conditions will vary according to the character of the wet season. In the northern pastoral areas monsoonal rains in the summer months may cause creeks and flats to be temporarily flooded; adequate moisture will be available for a time, for development of the eggs and growth of ephemeral grasses for the insects. Apart from weather factors, soil type and vegetation are important in relation to the distribution of the endemic centres of *Ch. terminifera*.

It would appear, therefore, that temporary invasions of the southern portion of South Australia by *Ch. terminifera* are closely correlated with the rainfall of particular seasons. The extent of the invasion

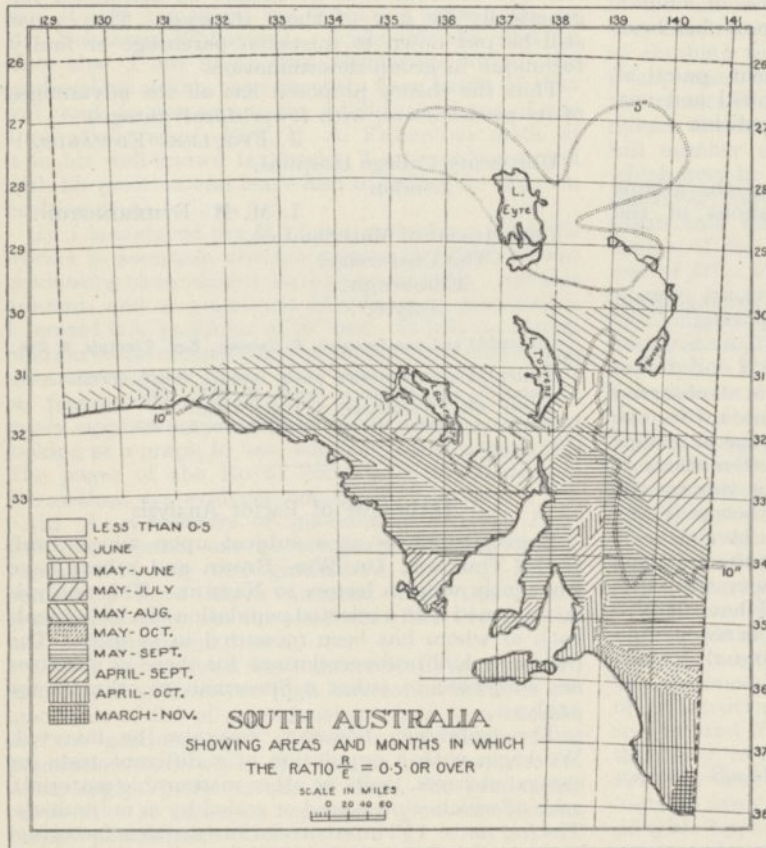


FIG. 1.

These widespread invasions develop only at irregular intervals of several years; the presence of the insects in numbers, in the southern areas of the State, is temporary. Restricted outbreaks occur more frequently in certain areas situated immediately north of the 10 in. isohyet; in some instances the swarms may extend southwards into the wheat belt.

Local grasshopper swarms appear from time to time during the summer months in the pastoral country north of the 10 in. isohyet; their appearance is associated with summer rains. The endemic centres of *Ch. terminifera* appear to be in this region but they have not yet been defined. The average annual rainfall over this portion of the State is about 5-10 in. (see Fig. 1); there are wide fluctuations about the mean from year to year, resulting in prolonged periods of drought; much of the rain falls during the summer months.

depends largely upon the duration of a combination of favourable conditions in the endemic areas and in the southern portions of the State. A detailed study of the ecology of the species is in progress.

JAMES DAVIDSON.

Waite Research Institute,
University of Adelaide.
June 15.

- ¹ J. C. Faure, *Bull. Entom. Res.*, **22**, 393; 1932.
² J. Davidson, *Aust. J. Exp. Biol. and Med. Sci.*, **11**, 59; 1933.
Trans. Roy. Soc. South Australia, **58**, 33; 1934.
³ J. A. Prescott, *Trans. Roy. Soc. South Australia*, **58**, 48; 1934.

Wood Hemicelluloses

SINCE the isolation of 'starch' from wood¹ another product has been obtained from the cell walls of oak sapwood which, instead of giving the usual blue colour with iodine, gives a royal purple colour reverting to blue on standing. This latter substance is more closely allied to hemicellulose A² than the starch of the cell contents since it appears to be made up of:

Uronic and aldobionic anhydride residues
(14 per cent approx.)
in addition to—
Anhydro-xylose (10 per cent approx.)
and
Anhydro-glucose residues .. (75 per cent approx.)

Attempts are now being made to prepare starch from oak leaves in quantities sufficient for analysis. A small sample already obtained has yielded on hydrolysis with 12 per cent hydrochloric acid an amount of carbon dioxide corresponding to 24.4 per cent of uronic anhydride. These results appear to permit of the formulation of the hypothesis that certain of the hemicelluloses of oak wood are derived from starch in a series of steps involving the oxidation of primary alcoholic groups and the subsequent formation of anhydro-xylose residues by decarboxylation. If the hypothesis is correct, the term 'hemicellulose' can no longer be applied to the acid polysaccharides in question, and the alternative general term 'amylo-uronides' is therefore suggested. If the furfuraldehyde-yielding complexes associated with the cellulose of wood are derived therefrom by a similar series of reactions, the term 'hemicellulose' might still be reserved for them.

W. G. CAMPBELL.

Department of Scientific and Industrial Research,
Forest Products Research Laboratory,
Princes Risborough, Aylesbury, Bucks.
July 6.

- ¹ Campbell, *Biochem. J.*, **29**, 1068; 1935.
² O'Dwyer, *Biochem. J.*, **23**, 2116; 1934.

Amorphous Antimony

IN a previous letter¹, I showed that a thin layer of antimony produced by distillation in a high vacuum is amorphous. This conclusion was drawn from the fact that the electron diffraction pattern consisted of broad bands always showing exactly the same appearance (width, intensity, etc.); this could scarcely be understood if the state were only colloidal. The following researches corroborate and extend this view:

When such an amorphous layer is heated to 120°–150° C. (the thinner layers requiring the higher temperatures), the diffraction pattern changes into the

ordinary powder diagram of antimony, consisting of a large number of sharp rings. If the original layer was very thin, the rings after heating remain more or less broad as a consequence of the small size of the crystallites; the difference from the original amorphous pattern is, however, unmistakable even in this case. In all cases the crystallites produced by heating are oriented at random, differing in this respect from those formed by spontaneous crystallisation at room temperature, described previously.

These results throw a new light on the so-called 'explosive' state of antimony, discovered by Gore almost a century ago. As is well known, this state is obtained by electrodeposition; in this case there is no upper limit to the thickness of the deposit obtainable. The diffraction patterns of such layers² proved to be identical with those of amorphous antimony described above. This shows that Gore's explosive antimony is essentially identical with our pure amorphous antimony. Explosive antimony is known, however, to include some 10 per cent of the salt electrolysed; this may be present as thin films (probably monomolecular) surrounding small quantities of pure amorphous metal, thereby inhibiting their crystallisation.

From this picture, it may be expected, for example, that the electric resistance of explosive antimony will not be determined by the metallic parts but mainly by the salt films³. Experimentally, I have found values for the resistivity about 100 times that of ordinary antimony, and other observers⁴ even give a factor 1000. These high values, as well as their irreproducibility, are arguments in favour of the view put forward above. Other properties, however, might be less sensitive to the presence and quantity of inclusions, and should then be the same as for pure amorphous antimony. As such we shall here consider the heat of crystallisation and the diamagnetic susceptibility:

It is well known that explosive antimony derives its name from the fact that it may change more or less explosively into ordinary antimony, or, as we may now say, it crystallises more or less explosively. This 'explosion' may be caused by scratching or by heating to about 97° ± 2° C. Now the heat of crystallisation liberated in this process, measured by E. Cohen and Th. Strengers⁵, is found to be 20 cal./gm. This is of the same order of magnitude⁶ as the heat of crystallisation from the liquid at the melting point (24 cal./gm.). I have measured the diamagnetic susceptibility of explosive antimony and find that it increases markedly when the transition to ordinary antimony is brought about. This is again in agreement with the change in diamagnetic susceptibility at the melting point. The two results together strongly suggest that the explosive (amorphous) state of antimony is the supercooled liquid state.

The experiments were made in collaboration with Mr. P. Teunissen in the laboratory of Prof. D. Coster. The full paper is to appear in *Physica*.

Natuurkundig Laboratorium
der Rijks-Universiteit,
Groningen.
July 22.

J. A. PRINS.

- ¹ NATURE, **131**, 760; 1933.
² I took photographs with copper K-radiation; see also H. Kersten, *Physica*, **2**, 276; 1932.
³ Included impurities may exert an analogous effect in sputtered layers, described by H. Zahn and J. Kramer, *Z. Phys.*, **86**, 413; 1933.
⁴ H. v. Steinwehr and A. Schulze, *Z. Phys.*, **63**, 815; 1930.
⁵ *Z. phys. Chem.*, **52**, 129; 1905.
⁶ G. Tammann und W. Müller, *Z. anorg. u. allg. Chem.*, **221**, 109; 1934.

Raman Effect in Solutions of some Amino Acids

THE purpose of this letter is to report some measurements of Raman frequencies in solutions of glycine, alanine, tyrosine and cystine, which have been observed as a preliminary to the development of a spectroscopic method of analysis for molecules of this class.

An air-cooled quartz-capillary mercury arc furnished the exciting light, filter solutions of sodium nitrite and praseodymium ammonium nitrate permitting excitation by the 4358 Å. line. The spectrograph was a two-prism glass instrument having a dispersion of 23 Å./mm. at 4500 Å.

Solutions (in water) of samples of glycine and alanine which had been recrystallised several times to remove impurities exhibited some fluorescence; this, however, decreased upon still further recrystallising. Introduction of a small amount of potassium iodide to these solutions quenched the fluorescence very effectively.

The observed Raman frequencies (in cm.⁻¹) together with visual estimates of the relative intensities are as follow :

Glycine (15 per cent solution in water, 10 per cent KI) :—506 (3), 899 (8), 1036 (4), 1112 (2), 1332 (8), 1411 (10), 1445 (4);

Alanine (15 per cent in water, 8 per cent KI) :—528 (2), 851 (6), 1305 (4), 1358 (5), 1383 (1), 1417 (10), 1466 (6), 1715 (4);

Tyrosine (5 per cent in 0.9 N HCl) :—646 (3), 844 (9), 1216 (6), 1359 (4), 1448 (1), 1620 (10);

Cystine (8.33 per cent in 1.1 N HCl) :—503 (10), 670 (10), 1633 (3), 1736 (3).

These lists are not to be regarded as complete for the spectral region covered, as weaker lines have been no doubt obscured by scattered continuous radiation from the mercury arc. The range of error of the measurements is roughly ± 3 cm.⁻¹.

To test the effect of varying the concentration, three solutions of glycine having concentrations of 7.5, 15 and 22.5 per cent were examined. The Raman lines showed no shift in position greater than 2 cm.⁻¹. Varying the amount of potassium iodide in these solutions from zero to 40 per cent also produced no shift greater than the error of measurement.

NORMAN WRIGHT.

Department of Physics, W. C. LEE.
University of Michigan.

July 10.

Initiation of the High-Frequency Discharge

WHEN the gas hydrogen in a wide tube is excited by means of a high-frequency alternating potential $V \sin 2\pi nt$, applied between two parallel plate electrodes, the relation between the sparking potential $V_s \sin 2\pi nt$, the gas pressure p , and the inter-electrode distance d for values of pd in excess of the critical value is of the simple form $V_s = A + Bpd$, where B is a gas constant and A depends upon the frequency n and the electrode surfaces¹.

This form of Paschen's law is consistent with the hypothesis that the peak potential V_E just before the initiation of the discharge is made up of two parts, (1) an electrode fall V_E and (2) a uniform field in the gas Bp . At pressures considerably in excess of the critical value, it may be assumed that V_E occurs in a very small fraction of the distance d . Then V_E will be approximately equal to A .

In the accompanying diagram (Fig. 1) an experimental curve is shown which exhibits the variation of V_s with p in a tube the electrodes of which were

of copper, 8 cm. in diameter and 2.58 cm. apart. The frequency of the applied potential was 2.03×10^7 c.p.s. This curve is typical of those which have been determined for frequencies between 8×10^6 c.p.s. and 9×10^7 c.p.s. It can be explained in terms of (1) ionisation by positive ions at the cathode and (2) ionisation by electronic impact in the gas. The former is connected with the electrode fall (72 volts) and the latter with the gradient $B = 21.6$ volts/cm./mm. of mercury.

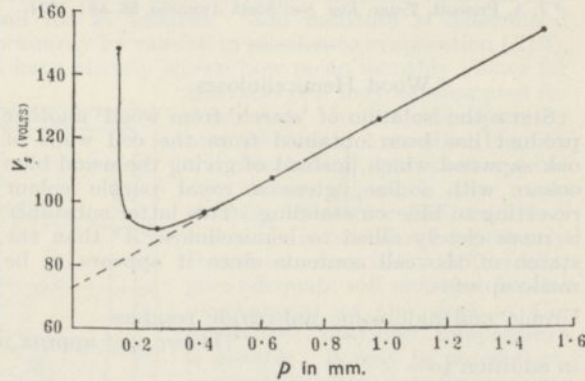


FIG. 1.

If it is assumed that a typical free electron moves under the action of the electric field so that $m\ddot{x} = Ee \cos(2\pi nt - \phi)$ and that a discharge occurs when the electron gains its ionising velocity at a given distance $L = K/p$ from its starting point, it can be shown that the mode of variation of E with p for a discharge is,

$$E = \frac{\pi n \sqrt{\frac{2V_0}{e/m}}}{\sin \frac{2\pi n K}{p\sqrt{(2V_0 e/m)}}} \dots (1)$$

For large values of p , $E = V_0 p/K$, giving the constant gradient $B = V_0/K$.

When various experimental curves are examined by these hypotheses, the following facts emerge :

(a) The ionisation potential V_0 of the gas is correctly predicted.

(b) The value of K is much larger than that deduced from the kinetic theory on the assumption that L is the electronic mean free path.

(c) In discharges at all high frequencies, the critical pressure p_c is such that $d = K/p_c$ where K is calculated from the gradient V_0/K .

This last fact indicates that the minimum E predicted by equation (1) is not in general observed. Owing to the relatively large electrode fall, the equation only holds at the minimum for certain frequencies or for tubes in which d is very large. Fig. 1 is drawn for a value of n for which the theory of equation (1) holds very exactly down to the critical pressure.

A detailed account of the experiments which have led to these conclusions, and of others relating to the initiation of discharges by means of constant potentials, will be published elsewhere in due course.

JOHN THOMSON.

Natural Philosophy Department,
The University, Glasgow.

July 1.

¹ J. Thomson, *Phil. Mag.*, 18, 696; 1934. The value given for B in this paper is in error, due to a mistake in the estimate of a capacity. The correct value for the experiments there described is 26 volts/cm./mm.

Multiplanar Cyclohexane Rings

IN 1931 I published a paper in the *Journal of the Indian Chemical Society* in which the four isomeric modifications of 4-methyl cyclohexane-1-carboxy-1-acetic acid were described¹. In a recent publication S. Goldschmidt and G. Grafinger² observed that they could not isolate the acid *B*, as described above, and consequently they concluded that actually 4-methyl cyclohexane-1-carboxy-1-acetic acid existed in only two modifications, one melting at 137° and the other at 174°. It appeared to me rather strange that the work, which was repeated a number of times before publication, should be altogether wrong. It was, therefore, considered desirable to get the work repeated once more in my presence, and this has accordingly been done now by a student of mine, Mr. Asutosh Mukherji, with the result that we found no difficulty whatever in isolating all the four modifications of the acid as described before. It may, however, be recorded here that the solubility of the ammonium salt of the acids *A*, *B* and *C* in absolute alcohol is as follows:

One gm. of acid <i>A</i>	dissolves in 75 c.c. of boiling absolute alcohol.
" " " <i>B</i>	" " 45 " " " "
" " " <i>C</i>	" " 34 " " " "

The quantity of the absolute alcohol must, therefore, be carefully regulated, otherwise, if acids *B* and *C* come out together in alcoholic solution, it becomes very difficult to separate them from one another. Regarding the suggestion of Goldschmidt that the acid *B* may be a eutectic mixture of acids *A* and *C*, it appears to be untenable and not based on experimental evidence. The mixture of the acids *A* and *C* gave at no time any sharply melting substance which would melt at 129° or near about it as the acid *B* does. The same is true for the acid *D* also. It is difficult to say whether it is the unsuitable method of separation adopted by the German chemists that is responsible for their failure to get the acid *B* and *D*. It may incidentally be mentioned that these isomers are not at all similar to any of those isolated from the *para* or *ortho* methyl cyclohexanone. Although all the expected isomeric acids from these latter ketones have not yet been isolated, the work so far completed will be published very shortly elsewhere.

The *p*-methyl cyclohexanone and other ketones of the series are now being prepared with different catalysts in order to see if the quality of the ketones has anything to do with the formation of the isomeric acids.

M. QUDRAT-I-KHUDA.

Presidency College,
Calcutta.
June 28.

¹ See NATURE, 127, 253; 1931.
² Ber., 68, 279.

Vapour Pressure of Hexadeuterobenzene

It has recently been recorded¹ that the vapour pressure of deuterium iodide is slightly, but definitely, greater than that of protium iodide, a behaviour qualitatively analogous to that exhibited by the two hydrogen fluorides². This type of anomaly is, therefore, not confined to substances which are generally recognised as associated in the vapour state³.

We know an even clearer example: the vapour pressure of C₆D₆ is greater than that of C₆H₆ for the whole temperature range 0°–80° C. (below the

freezing point, 6·8°, the liquid is supercooled) over which we have measured it. The boiling point of C₆D₆ at normal pressure is 0·8° lower than that of C₆H₆, contrary to a recent claim that the former is higher⁴.

C. L. WILSON.

University College,
London.
July 29.

¹ Bates, Halford and Anderson, *J. Chem. Phys.*, 3, 415; 1935.
² Claussen and Hildebrand, *J. Amer. Chem. Soc.*, 56, 1820; 1934.
³ Lewis and Schutz, *ibid.*, p. 493. Wilson, *J. Chem. Soc.*, 492; 1935.
⁴ Clemo and McQuillen, *J. Chem. Soc.*, 851; 1935.

Inverse Probability

IN my letter¹ of May 4, I was not defending Eddington's solution of his problem in inverse probability, but was attacking Dr. Dingle's discussion² of his own simplified problem: If *A* and *D* each speak the truth once in three times independently, and *A* says that *D* lies, what is the probability that *D* speaks the truth? In his discussion Dr. Dingle said, "Sir Arthur's treatment effectively combines the knowledge of *D*'s moral character with that of *A*'s. But is it not clear that such combination is purely fictitious? From our knowledge of *D* the probability is $\frac{1}{3}$; from our (independent) knowledge of *A* it is $\frac{2}{3}$. The results are inconsistent because the data are independent; we are effectively defining probability in different ways". It should be clear from my solution of Dr. Dingle's problem that the answer is neither $\frac{1}{3}$ nor $\frac{2}{3}$, but $\frac{1}{2}$, and nothing else. There are really no inconsistencies, as I showed by drawing up the association table.

I do not agree with Dr. Dingle's more recent¹ assertion, that one must "... either (a) define probability in a purely mathematical way and so obtain a unique solution which may be both consistent and correct . . . , or (b) refrain from calling meaningless mathematical functions 'probability', and then obtain two solutions to each problem". My treatment used "probability" in the simplest and perhaps most significant meaning of the word. Out of 4*N*/9 cases where *A* says that *D* lies, *D* actually lies 2*N*/9 times and tells the truth 2*N*/9 times. Does Dr. Dingle seriously maintain that the ratio, 2*N*/9 ÷ 4*N*/9 = $\frac{1}{2}$, is a "meaningless mathematical function", or that, given that our case is one of these 4*N*/9 cases, there is any lack of significance in saying that the probability that *D* tells the truth is $\frac{1}{2}$?

Although I cannot subscribe to Dr. Dingle's arguments, I am inclined to agree with him that Eddington's solution was incorrect. The data supplied by Eddington do not seem to me to be sufficient to allow one to write down the class frequencies in a contingency table.

T. E. STERNE.

Harvard College Observatory,
Cambridge, Mass.
July 11.

¹ NATURE, 135, 1073; 1935.
² NATURE, 135, 451; 1935.

The point at issue between Dr. Sterne and myself is ultimately whether consistency is equivalent to significance or not. Evidently it is not easy to clear it up in a few sentences, and the Editor has invited me to write an article on the whole question of probability which will appear in NATURE shortly.

I will only say here that in the passage which Dr. Sterne quotes from my review, I called the results "inconsistent" because they were ostensibly different values for the same thing—"probability". I thought it would be understood that if those two things were called by different names, and made no pretensions to be the same thing, there would be no inconsistency. In other words, I did not attribute inherent inconsistency to the problem but to two possible ways of defining the solution.

HERBERT DINGLE.

Imperial College of Science,
S.W.7.
July 31.

Constitution of the Prosthetic Group of Catalase

KARL ZEILE¹ in 1930 was the first to provide evidence that the catalytic activity towards hydrogen peroxide of purified preparations obtained from liver and from marrow seedlings is intimately connected with a pigment exhibiting the spectral behaviour of a complex consisting of a hæmatin group—the iron being stabilised in the trivalent state—and of a colloidal component. The position of the absorption bands of the pyridine hæmochromogen and of the porphyrin, obtained in solution by treatment with hydrazine and acetic acid, led him to conclude that the hæmatin contained in the enzyme complex was either identical with, or was an isomer of, the prosthetic group of natural hæmoglobin.

Solutions rich in catalase were obtained by a method embodying fractional alcohol precipitation, removal of hæmoglobin by chloroform denaturation, adsorption of the enzyme on alumina gel, elutriation with secondary sodium phosphate, and concentration by acetone-CO₂-treatment in the cold. The active hæmatin-protein complex was split by acid acetone, the hæmin precipitated by evaporating the acetone, and recrystallised from propionic acid and HCl in order to remove admixed biliverdin crystals. About nine milligrams of a pure hæmin were obtained from the catalase prepared from fifty pounds of horse liver. The spectroscopic properties and the enzymatic activities of the various fractions were determined throughout.

The hæmin, when acted upon by hydriodic acid and glacial acetic acid, yielded a porphyrin the spectrum of which was identical with that of a sample of pure mesoporphyrin IX kindly given to me by Prof. Otto Warburg. The dimethyl ester obtained by treatment with HCl in methyl alcohol shows the same spectrum as does mesoporphyrin-IX-dimethyl ester. Final proof of the identity is afforded by the fact that the compound (m.p. 214°, uncorr.), when added to an equal amount of synthetic mesoporphyrin-IX-dimethyl ester (m.p. 212°, uncorr.) caused no depression of the melting point of the latter (mixed melting point 213°, uncorr.). I am indebted to Prof. Hans Fischer for a sample of the synthetic ester.

The conclusion seems, therefore, to be justified that the hæmatin group of catalase is a derivative of ætioporphyrin III and possesses a porphyrin skeleton with the same arrangement of the side chains as is found in the natural blood pigment, that is, in proto-hæmatin IX.

It is, perhaps, of interest to note that according to D. Keilin and R. Hill² and to K. Zeile and F. Reuter³, the component *c* of cytochrome is also a derivative of ætioporphyrin III.

The details of this investigation will be published elsewhere.

The high activity of catalase is obviously due to the union of the hæmatin with a special protein⁴. Work on the nature of this protein is being continued.

KURT G. STERN.

Courtauld Institute of Biochemistry,
Middlesex Hospital Medical School,
London, W.1.

July 23.

¹ K. Zeile and H. Hellström, *Z. physiol. Chem.*, **192**, 171; 1930. **195**, 39; 1931.

² R. Hill and D. Keilin, *Proc. Roy. Soc., B*, **107**, 286; 1930.

³ K. Zeile and F. Reuter, *Z. physiol. Chem.*, **221**, 101; 1933.

⁴ K. G. Stern, *ibid.*, **208**, 86, **212**, 207; 1932. **215**, 35, **217**, 237 **219**, 105; 1933.

Colour of the Positive After-Image of a Colour

IN certain conditions, the colour of the positive after-image of any colour or white is purple. It is best to use only one eye and to have both eyes covered with a black cushion before performing the experiment. The object should then be viewed for the shortest possible time and the black cushion be replaced over the eye. If tried with a spectrum, the whole of the after-image becomes purple.

If on a piece of white cardboard eighteen inches square a series of small squares of red and blue cardboard, each about three quarters of an inch square, be pasted to cover a surface of about nine inches square, and the whole is placed in sunlight and viewed as previously mentioned at a distance of about three feet, a brilliant positive after-image, red, blue and white, will be seen for a fraction of a second. Then all changes to purple, which becomes brighter and then disappears from without inwards in about eight to twelve seconds without becoming negative; the last thing to be seen is a whirlpool movement in the centre of the field of vision.

With spectral colours projected on a screen in a dark room the positive after-image of all becomes purple and disappears without changing to negative when viewed for the shortest possible time. When the eye is moved, the after-image spreads out, a portion of the retina not previously stimulated being affected.

These facts suggest very strongly that the photochemical stimulus in vision is liquid and movable in the retina.

F. W. EDRIDGE-GREEN.

Board of Trade,
S.W.1.
July 18.

Dental Caries in Prehistoric South Africans

THE Matjies River Shelter¹ has yielded a very large number of skulls with hundreds of teeth. The deposit commences with a form of the Mossel Bay culture (which may be called Early Mossel Bay) which, in natural superficial strata of the neighbourhood, and in a shelter about eight miles away at Plettenberg Bay, follows immediately on the last phase of the Stellenbosch culture. This phase of the Stellenbosch can be found from Plettenberg Bay to Mossel Bay in a hard red sand lying immediately below the surface layer of black sand, and may therefore be accepted as the end of the Pleistocene; the whole of the deposits of the Matjies River Shelter must therefore be taken to be Holocene.

My collection contains: teeth of one burial from

the late Stellenbosch of Plettenberg; teeth of two adult and one baby burials from the Early Mossel Bay of Matjies River Shelter; teeth from one burial of the same layer, Plettenberg Bay; teeth from about fifteen burials, with cremated heads, near the top of the Mossel Bay layer; teeth from more than a dozen adult burials in the Wilton-without-pottery layer. *In not one of this large collection of teeth is there the slightest sign of dental caries.*

After this the deposit changes completely; it now consists almost wholly of shells (largely *Mytilus*) instead of ashes; and, from now onwards, caries is very common.

The indication from this area therefore bears out the experience of European anthropologists—that caries is a comparatively modern disease and that no skull showing this condition can be regarded as ancient. Will anthropologists, in view of these facts, revise their views on certain South African finds—I may be allowed to mention particularly the Broken Hill and the Springbok Flats skulls?

T. F. DREYER.

Department of Zoology,
Grey University College,
Bloemfontein. July 28.

¹ Keith and Dreyer, *Roy. Soc. S. Africa*, 21, Pt. II.

Nomenclature of Corpus Luteum Hormone

DURING the past year, the progestational hormone has been isolated from the corpus luteum in pure form and its constitution established. Heretofore, two different names have been used in the literature for this hormone (progesterin, luteosterone). For the sake of international uniformity, we agree to use hereafter in the scientific literature only the name *progesterone* for the pure hormone. As is known, the pure hormone exists in two different forms, one melting at 128° (uncorr.) and the other at 121° (uncorr.). The higher melting form (Compound B of Wintersteiner and Allen¹ and Compound C of Slotta, Ruschig and Fels²) will be known as α -progesterone, and the lower melting form (Compound C of Wintersteiner and Allen and Compound D of Slotta, Ruschig and Fels) as β -progesterone. We hope that these names will be generally accepted in the scientific literature.

W. M. ALLEN.
A. BUTENANDT.
G. W. CORNER.
K. H. SLOTTA.

Breslau.

Danzig Langfuhr.
Rochester, N.Y.

¹ O. Wintersteiner and W. M. Allen, *Biol. Chem.*, 107, 321; 1934.

² K. H. Slotta, H. Ruschig und E. Fels, *Berichte der deutsch. chem. Gesell.*, 67, 1270; 1934.

Points from Foregoing Letters

In reply to Mr. Buchanan-Wollaston's criticism of British statistical methods, Prof. Karl Pearson enumerates some of the uses of the P , χ^2 test, which was devised to find whether a given curve used in graduating observations was a good 'fit'.

When blood from two individuals is mixed, clumping of the red corpuscles may occur, a fact of great importance in blood transfusion. Human beings have been classified into four groups A , B , AB , and O , according to their behaviour when mixed. Dr. J. F. Edwards and Dr. I. M. H. Etherington propose a new theory of blood group inheritance, depending on two linked pairs of Mendelian factors, the hypothesis of 'crossing-over' being discarded.

Dr. J. Davidson gives a chart showing the rainfall-distribution ratio in South Australia in relation to the recent outbreak of the migrating grasshopper, *Chortoicetes terminifera*, showing the necessary soil moisture needed for the development of eggs of that insect.

Further investigations to determine the steps by which the hemicellulose constituents of the wood of the oak are formed from starch are reported by W. G. Campbell.

X-ray investigations show that the electrolytically deposited 'explosive antimony', so-called because it crystallises more or less explosively when scratched or heated, is identical with the amorphous films of antimony produced by distillation in a high vacuum. Dr. J. A. Prins suggests that they represent a super-cooled liquid state.

As a step towards the spectroscopic analysis of amino-acids, Norman Wright and W. C. Lee have determined the Raman spectra of the light scattered by solutions of glycine, alanine, tyrosine and cystine.

Dr. J. Thomson discusses the mechanism of the initiation of the high-frequency glow discharge in hydrogen. From the results of his experiments, he concludes that there is space-charge present before the discharge begins and that this produces a non-uniform electric field. The experiments are consistent with a simple theory of ionisation by electronic impact. The ionisation potential of the gas may, in certain circumstances, be deduced from the results.

The observation is made by Dr. C. L. Wilson that as the boiling point of hexadeuterobenzene is lower than that of ordinary benzene, benzene behaves in a manner analogous to hydrogen fluoride, hydrogen iodide and acetic acid.

Dr. Dingle admitted that Dr. Sterne had obtained a unique solution of an apparently inconsistent problem of Dr. Dingle's, in inverse probability; but contended that Dr. Sterne's combination of the data had nothing to do with probability. Dr. Sterne disagrees with this contention, claiming that he uses "probability" only in a simple, usual and significant meaning of the word. Dr. Dingle still holds to his position, which he promises to maintain in a forthcoming article.

The non-protein radical of the enzyme catalase (found in liver and in most living tissues) has been isolated by Dr. Kurt G. Stern, who shows that it is derived from aetioporphyryn III; this is also the case with the component c of cytochrome, a cell-pigment, originally found in muscle, which plays an important part in the utilisation of oxygen by living tissues.

ERRATUM. The approximate velocity of slow neutrons as indicated by the experiments of Dr. O. R. Frisch and E. T. Sørensen, mentioned in this column in NATURE of August 17, should have been 2,000 metres per second instead of 200.

Research Items

Archaeological Research and Peat Deposits in East Anglia

IN the report on the recent excavations at Peacock's Farm, Shippea Hill, Cambridgeshire, on behalf of the Fenland Research Committee, by Mr. J. G. D. Clark, Dr. H. and Mrs. M. E. Godwin and Mr. M. H. Clifford (*Antiquaries J.*, 15, 3), reference is made to the employment of two distinct, but complementary, methods of peat analysis as an aid to the work of the archaeologist. Of these the first, pollen analysis, is by now familiar. The second, that of examining all other plant remains in the peat beside pollen, has been carried out at Peacock's Farm by Mr. M. H. Clifford. At present it is regarded as only in an early stage, but promising useful development. It has the great advantage that it is an index of the vegetation actually growing on the site in a way impossible for pollen analysis only. In the present instance, in the lower peat below forty-eight inches, all the wood present consists of alder roots, though the pollen analysis shows that the alder was not present at this level. Pine wood is absent, though pine pollen is present and strikingly dominant. In the black layer of the microlithic horizon the plant remains are unidentifiable, except for alder rootlets and a few fruits of hemp agrimony. At 30 inches, a striking change occurs. Wood is very abundant, and there are leaves and fruits of many trees and bushes. At 32 inches, stem wood of alder occurs for the first time, supplemented at 28 inches by stem wood of ash and hazel, at 14 inches by *Rhamnus catharticus* and at 4-6 inches by elm-wood. To these must be added fruits of *Rhamnus catharticus*, dogwood, hazel, raspberry and leaves of oak. This assemblage suggests dense bush and tree growth corresponding to the later stages of 'carr' development in present-day vegetation. From 16 inches to the top of the upper peat there are signs of a return to aquatic conditions, first in the fruits of hemp agrimony and prickly sedge, and afterwards in the rhizomes of reed-mace. There is no evidence of a break in the peat formation due to land uplift or other cause.

Conventionalisation of Design in the Solomon Islands

THE simplification and modification, including elaboration in geometric form, of a naturalistic design in the Solomon Islands has been analysed by Capt. T. A. Joyce (*Man*, 108, July) in relation to a peculiar element, which constitutes a constant feature in the turtleshell network of head ornaments. These are worn as forehead ornaments by the people, and consist of a white shell disc overlaid with a 'fret-work' of turtleshell. The delicate fretted patterns bear witness to a remarkable degree of technical skill on the part of a people who had no sharper tool than a shark's tooth. Since the ornaments are circular, the design is radial, and an almost consistent element is a series of spokes, with what may be termed an 'elbow' in the centre of each, the cutting of which must have been a matter of considerable difficulty. It seems likely, therefore, that this feature must have a definite meaning. A clue is afforded by the hollow wooden figures of a bonito fish in which the skull and jawbones of a dead man are enclosed after the great funeral feast has been held. In an

example of such a bonito fish now in the British Museum, the back fin of the bonito is its most prominent figure; and the bonito itself is important in Melanesia as a clan-badge. The analysis of the development of the bonito fin can be followed further in the design of a bamboo lime box, also in the British Museum, in which the fish appear reduced to their lowest dimensions; but in all of them there is a highly developed back fin. In these the design is a white fish on a shaded ground; but if the design is reversed to become a shaded design on a white ground, we get the *motif* provided by the radial bars with elbows of the head ornaments. The design on the lime box, therefore, appears to explain that of the head ornaments and to afford another example of the tendency of life forms, simplified and repeated, to become geometrical.

Evolution of the Skull in Horses

THE evolution of the skull in the Equidae is the subject of two papers by Dr. R. Cumming Robb (*J. Genetics*, vol. 31, No. 1). By measurements of the skulls of various fossil and living horses, he shows that increase in size from the Eocene *Hyracotherium*, weighing perhaps 20 lb., to the modern Percheron weighing more than 2,300 lb., is accompanied by progressive increase in the pre-ocular length. In titanotheres evolution, on the contrary, the preponderance of increase has been in the post-ocular region. This continuous evolution in the shape of the horse skull is a concomitant of one hundred-fold increase in the weight of the animal. If the animal is as small as *Hyracotherium*, the facial index (face length/cranium length) is about 0.8. *Merychippus* and a Shetland pony are of larger but similar size, and have a facial index about 1.5. The law of relative growth will thus account for continuous change in the proportions of the skull, but size mutations may be required to explain the progressive increase in the size of the animal. By measurements of foetal and post-natal stages in the development of the horse, Dr. Robb shows the same progressive preponderance of the face, with the same linear relationship between muzzle length and skull length. The 'orthogenetic' trend in the evolution of the skull is therefore regarded as a direct result of the increasing size of the animal. Whether this evolutionary increase in size, which is characteristic of so many animal groups, has been aided by natural selection, and whether it has been determined by mutations in size genes, remains undetermined.

The Gorgonid Family, Plexauridæ

IN a series of three recent publications, Dr. G. Stiasny has made notable contributions to our knowledge of the Gorgonaceæ. The major of these (*Siboga-Expeditie, Monographie XIIIb*⁷. Leyden: E. J. Brill, 1935) is a revision of the Plexauridæ based not only on the *Siboga* material, Nutting's original account of the *Siboga* Plexauridæ being insufficient, but also on other material in the possession of the Rijksmuseum van Natuurlijke Historie at Leyden, including two collections made by Prof. H. Boschma at the Tortugas and Bermuda in 1925. Seven new

species and two new varieties are described, while one species receives a new name. There are many new records of distribution of both Indo-Pacific and Atlantic species. Dr. Stiasny, following Prof. S. Hickson in this, deplors the lack of experimental data on the effect of environment on the form of Gorgonids. It is indeed more than time that systematists were not only able but also actually encouraged to study their material, where possible, in the living condition. This necessity is borne out by the second of these communications (*Zool. Anz.*, 110, 179-190; 1935) in which Dr. Stiasny re-describes *Briareum arbestinum*, Pall., the most abundant, and among the most thoroughly studied, of all West Indian Gorgonids. He was able to do this owing to the beautiful preservation of material collected by Prof. Boschma at the Tortugas. The polyps are much larger than previously described and the canal system different. The third paper (*Zool. Anz.*, 109, 236-245; 1935) contains a short summary of the diagnostic features of the known species of the family Plexauridae.

Nerve Plexuses in *Amphioxus*

DR. J. BOEKE describes (*Quart. J. Micr. Sci.*, 77, Pt. IV; 1935) a nerve plexus on the wall of the liver and adjoining parts of the intestine of *Amphioxus*, with numerous stellate ganglion cells, which may be compared with the plexus of Auerbach of the higher vertebrates. A layer of smooth muscle cells is present with which the processes of the ganglion cells and the nerve fibres of the plexus are in connexion. Covering this layer of smooth muscle cells is a thin layer of connective tissue in which is found a more delicate nervous plexus, analogous to the plexus of Meissner, connected with the first plexus. The nature of the synaptic connexions of the dendrites of the ganglion cells with the nerve fibres of the plexus is discussed. The author is of opinion that there is a true syncytial synaptic connexion; he figures the synapses between dendrites of the ganglion cells and the nerve fibres, and states that there appears to be a real continuity of substance and especially of the neurofibrillar substance. He is totally against the presence at the synaptic junction of a dead intermediate substance of a sticky nature, as is maintained by some neuronists. The enteric plexus is connected by means of the visceral nerves and the dorsal roots with the central nervous system.

New Pinnotherid Crabs

New species of the genus *Pinnixa* are described by T. Sakai from Japan and by Steve A. Glassell from the Gulf of California (Science Reports, Tokyo Bunrika Daigaku, Section B, No. 29, Dec. 1934; and *Trans. San Diego Soc. Nat. Hist.*, 8, No. 5, March 1935). The genus consists of 34 species, three of which are fossil, and the species are mostly commensals of worm tubes and are found abundantly on the Atlantic and Pacific coasts of America. Only two have previously been reported from Japan, *P. tumida*, a commensal in the cloaca of *Caudina chilensis*, and *P. penultipedalis*. A third species formerly thought to be *P. occidentalis* is now found to be new, and the author proposes for it the name *P. rathbuni*. He now adds two new species, *P. balanoglossana*, living as a commensal in *Balanoglossus misakiensis*, and *P. haematosticta*, which was collected among dead shells. A key to all these species is given and a description of the new forms. The preliminary

descriptions of *P. abboti*, *P. fusca* and *P. felipensis* by Mr. Glassell do not mention any hosts. Fuller descriptions and figures will be published in his forthcoming partial revision of the genus.

Propagation of the Hyacinth

THE *Gardeners' Chronicle* of August 3 contains an interesting article on "British-Grown Hyacinths" by Mr. D. E. Horton. Various aspects of the British trade in bulbs are reviewed briefly, but a large part of the paper is devoted to a description of methods of propagation of the hyacinth. The older method was to make three V-shaped cuts across the root-plate of the bulb, then place it in sand to callus, store it at a warm temperature with suitable humidity, when bulbils would appear at the bases of the scales. A newer method is to scoop out the root-plate with a special knife, and to follow with similar storage conditions. Scooping gives an average of 60-80 bulbils per plant, whilst cross-cutting usually yields only about 20. Moreover, the scoop-formed bulbils make their own roots, whilst cross-cutting produces roots from the mother bulb. Commercial practice suggests, however, that it is best to scoop strong varieties and to cross-cut slower propagators.

Longevity of Fungi

AN interesting paper by Ö. Winge and Aase Hjort, describing experiments on some ancient cultures of fungi, has recently appeared (*C. R. Trav. Lab. Carlsberg, Série Physiologique*, 21, No. 2, pp. 51-58, 1935, "On some Saccharomycetes and other Fungi still alive in the Pure Cultures of Emil Chr. Hansen and Alb. Klöcker"). Winge used cultures 16-17 years old, whilst Hjort, continuing the same investigation, had cultures 31 years old. The Carlsberg Laboratory possessed the original pure cultures, and these have now been tested for vitality by the authors of the paper under review. The oldest living cultures, of a species of *Zygosaccharomyces*, date from 1886—a span of forty-seven years, whilst *Saccharomyces Pastorianus* and *S. validus* had retained vitality for forty-five years in 1934. Solutions of 10 per cent saccharose or beer wort were the culture media employed, whilst Pasteur flasks reduced evaporation to a minimum.

Sediments in the Atlantic Ocean

IN the first part of "Die Sedimente des Äquatorialen Atlantischen Ozeans" (*Wiss. Ergebn. d. Deutschen Atlantischen Exped. auf dem Forschungs- und Vermessungsschiff Meteor, 1925-1927*, 3, No. 3, Lief. 1. Berlin and Leipzig: Walter de Gruyter and Co.) an account is given by Dr. C. W. Correns of the methods of collecting the bottom samples, which were taken on a series of traverses between 10° S. and 20° N., and of their examination both on board ship and afterwards. Estimates were made of the hydrogen ion concentration, carbonate, organic matter, manganese, titanium, iron and phosphorus, etc., as well as of particle size, and the comparison of the latter in fresh and preserved samples is particularly useful. An account is also given of the use of X-ray analysis for the detection of the mineral constituents. The second part, by Dr. W. Schott, describes the distribution of the pelagic foraminifera in the surface waters and in the bottom samples. In the former, their distribution seems to be conditioned by the temperature and phosphate content. Stratigraphically the cores show three layers,

distinguished by their *Globorotalia menardii* content, and probably deposited respectively before, during and since the last ice-age.

Water Exchange through the Straits of Dover

VARIATIONS in the exchange of water between the English Channel and the North Sea have a profound effect on the development there of young fish and of the planktonic animals on which fish feed. Dr. J. N. Carruthers has now published his second report on "The Flow of Water through the Straits of Dover as gauged by Continuous Current-meter Observations at the Varne Light-Vessel" (Min. of Agric. and Fish., Fish. Invest., Series II, 14, No. 4; 1935), which contains data for 1928-35. Considerable variations have been found in the average set of the current in different years and at different seasons. A marked loss of easting in the current distinguishes the last four from the first four years of the observations, and this fits well with other records of a change in the nature of the waters bathing the south and east coasts of Great Britain. Interesting relations have emerged between the Dover Straits current on one hand and the current round the north of Scotland and the success or failure of herring, plaice, cod and haddock year classes on the other.

Ray Tracks in Photographic Emulsions

H. J. TAYLOR (*Proc. Roy. Soc.*, June 1) has investigated the tracks of α -particles and protons in photographic emulsions, and A. Jdanoff (*J. Phys.*, June) has also worked on this problem. The tracks consist of developable grains, spaced a few microns apart, and are of length corresponding to the range of the particles in the emulsion. Taylor was able to obtain a special emulsion from Messrs. Ilford which was remarkably free from any background of spurious grains. With these plates, all the grains struck by an α -particle became developable, but only a proportion of those struck by a proton. The density of the grains along the track may be used to distinguish between proton and α -tracks. The plates were used to detect the H-particles knocked forward in neutron-hydrogen collisions, but Mr. Taylor thinks the uncertainties of the method do not allow it to be used for the determination of the distribution in detail of neutron energies. Jdanoff uses emulsions specially made to register H-particles and examines the tracks by a stereoscopic microscope method, which helps him to distinguish tracks from chance agglomerations of particles. He claims to be able to detect collisions and disintegrations, just as in the Wilson chamber.

The Oxide-Coated Cathode

M. BENJAMIN, working in the G.E.C. Research Laboratories, Wembley, has investigated the effect of additions to the nickel cores on the thermionic emission from oxide-coated cathodes (*Phil. Mag.*, July), and has found that some metallic additions can profoundly affect the emission. The proportion of added metal was of the order 0.5 per cent. Titanium was found to increase the emission, manganese and iron reduce it, while magnesium produces a temporary increase. It is suggested that the increase is brought about by the reduction of the barium oxide coating by the metal of the core, giving an increased concentration of active barium metal in the coating. This view is supported by the high emission obtained from a filament coated on a case containing the very potent reducer aluminium.

During the course of the measurements, it was also found that the oxide-coated filaments fail to show saturation emission at very low temperatures, and this phenomenon is correlated with the change from electronic to electrolytic conduction through the coating as the temperature is lowered. In filaments containing aluminium or titanium, the higher barium concentration results in the electronic conductivity persisting to lower temperatures, and these filaments show saturation at lower temperatures than a pure nickel filament.

β -Glucosidase of Sorghum

ALTHOUGH Emil Fischer regarded α - and β -glucosidases as two distinct enzymes, and this view is supported by a number of recent observations, evidence may be found in the literature which suggests the possible identity of the two enzymes. Of interest in this connexion are the results of experiments on the β -glucosidase of *Sorghum saccharatum*, carried out by C. Antoniani (*Rend. R. Ist. Lombardo Sci. e Lett.*, 68, parts 6-9). The β -glucosidase examined was obtained either by macerating the ground, germinated sorghum seeds with water in presence of toluene, or by extraction with ammonia solution, followed by purification with acetic acid and alcohol. The velocity of hydrolysis of cellobiose by the enzyme is at first greater than that of salicin, but after 15 per cent of the substrate has been hydrolysed, the position is reversed. The action on salicin is somewhat retarded when glucose, but not when galactose, is added. It appears, from the results obtained, that the sorghum seeds contain an emulsin devoid of β -galactosidase.

Greenwich Catalogue of Stars

THE "Second Greenwich Catalogue of Stars for 1925.0" has been published by H.M. Stationery Office. Part I contains the Right Ascensions and Declinations of 2,111 fundamental stars, observed during the years 1922 to 1930, reduced to the equinox of 1925.0, and Part II contains similar data for 10,584 stars in the zone $+32^\circ$ to $+64^\circ$ observed in the same interval. In both cases, Newcomb's precession and Boss's proper motions have been used in effecting the reduction to the adopted equinox (that of 1925.0). The Right Ascensions adopted for the clock stars are those of the Greenwich observations of 1915-1921. A correction to Newcomb's equinox, namely, -0.050^s , has been adopted in forming the catalogue. Every catalogue star has been observed at least five times in the period 1922-1930. The observations have been made with Airy's transit circle, which itself dates from 1850, and is responsible for the earlier Greenwich catalogues which have been incorporated in the data for proper motion. Although the telescope is the same, the modern observations are much more accurate on account of the application of the impersonal micrometer. In computing the proper motions, a modern place has been found for each star by combining the two most recent catalogues of Greenwich (including the present volume), the Cape, and Pulkova. The star's position for 1875.0 is worked out from the information available in eighteen catalogues, including earlier Greenwich catalogues, made about that time. The probable error of a proper motion varies from $0.001''$ to $0.010''$ according to the number of observations that have been made at one observatory or another.

Chemical Industry in the United States

PERHAPS the most remarkable thing about the meeting of the American Chemical Society held in April last in New York, and widely heralded as the "Official Tercentenary" of American chemical industry, was the presence of more than 25 per cent of the very large membership, some 17,000, of that Society. No body in Great Britain can count on such loyal support, and it affords a fine illustration of that 'working together' spirit which is carrying the chemical industry forward, so far and so fast, in the United States. Naturally the fare provided was very varied, though by collecting the papers into appropriate groups, it was possible for those with similar interests to forgather.

The social side was well to the fore, a feature being the replacement of elaborate and costly functions by a series of breakfasts, luncheons and dinners, arranged for the alumni of the numerous universities.

The opportunity for propaganda was not missed, including on one hand addresses of a general or topical character delivered by the leaders of the industry, whilst the Press was supplied with a large amount of suitable copy portraying the popular aspect and utility of the work of the chemist. They do these things well in New York under the guidance of the veteran secretary, Mr. Charles L. Parsons, and it is probable that nothing was left undone to make the meeting a gigantic success. It is worthy of comment that all the meetings could be held in the Hotel Pennsylvania, whilst the many delegates could

be housed there and in three neighbouring hotels, all connected by underground passages.

Apparently the American chemical leaders are not afraid to criticise the administration. Mr. William B. Bell, president of the American Cyanamide Company, whose theme was "Recovery—by Alchemy or Chemistry", claimed that there is too much Government planning and too much Government waste; the one sound basis of industrial planning being that of purchase and sale, or profit and loss with no political interference or domination. A director of the Du Pont Company claimed that they are on the way to establish an American synthetic rubber industry, and that this has been made possible by the experience gained in the dye industry, which in particular must be in a position to expand quickly in a national emergency to make a variety of essential organic substances.

Emphasis was also laid on the popular use and significance of vitamins, preparations containing such now having the third largest sale in the drug stores.

As a novelty, it was proclaimed that young cereal grasses cut just prior to jointing have, when dry, a biological value many times that of the common vegetables and that men and women will be eating grass in the near future.

Altogether as wide a range of subjects were discussed as must have been dealt with in that famous conversation between the Walrus and the Carpenter—"and why the sea is boiling hot and whether pigs have wings".

Third International Congress of Soil Science

FIFTY countries were represented among the four hundred delegates who attended the Third International Congress of Soil Science held in Oxford on July 30–August 7. The occasion afforded an unrivalled opportunity for discussing the many aspects presented by every problem in soil science, but differing widely according to the geographical region in which the problem is studied. One of the most urgent needs of the science is to break down the parochial barriers which necessarily limit the views of workers confined to one climatic or physiographic region, and faced with the whole-time task of economically justifying their existence. That parochialism exists was amply evident at the Congress, as also were the difficulties of overcoming it; but it was equally evident that the holding of an international congress is a practicable means of producing some kind of order among the conflicting theories held by the world's most eminent pedologists.

The discussions brought into prominence several new directions in which this young science is developing. In the Soil Physics Section, the main interest centred round problems of soil moisture, and Dr. R. K. Schofield introduced a 'pF' scale which precisely specifies the degree of wetness or dryness of a soil

in much the same way that Sorensen's pH scale specifies the degree of acidity or alkalinity. The pF is the (positive) logarithm of the amount by which the free energy of the water in the soil is less than that of water in bulk at the same temperature and external pressure expressed as the height in centimetres of a water column. 1 cm. above a free water table is, therefore, pF0 while the 'oven dry' state is approximately pF7. The use of this scale enables a great mass of hitherto unrelated data to be welded together to make an orderly picture of aspects of soil moisture behaviour which are of special importance in irrigation. Dr. Schofield stressed the necessity of recognising hysteresis in the relationship of pF to moisture content, which he regards as due mainly to microplastic resistance to swelling and shrinking.

In the Chemistry Section much attention was directed, as usual, towards the base-exchange properties of soil colloids, particularly from the mineralogical point of view. The structure of montmorillonite and beidellite, as proposed by Hofman, Endell and Milne, was discussed, and Dr. C. E. Marshall showed that the apparent contradictions between their structure and the chemical formulae can easily be removed by considering the operation

of certain replacements, aluminium for silicon in beidellites, and magnesium for aluminium in montmorillonites. Prof. C. H. Edelman proposed an alternative explanation for the base-exchange properties of the clays, having special reference to halloysite, which he regards as having marked exchange properties.

The Soil Fertility Section held a noteworthy discussion on the methods of estimating the manurial requirements of soils. Prof. E. A. Mitscherlich presented the first results of a great co-operative investigation, in which already 120 soils from different parts of the world have been studied, using more than thirty different methods. This investigation is a model of what can be attempted by international co-operation. Prof. O. de Vries surprised his hearers with an account of the number, running into tens of thousands, and the scope of the field experiments which have been made in the Dutch East Indies. Prof. R. A. Fisher followed this practical account by demonstrating the principles upon which the design of field experiments must be based if their results are to be of any real value. He made clear what is often overlooked, that accuracy alone is not enough, unless the *degree* of accuracy is also known. The very large number of papers dealing with the practical side of soil science which were presented to the Soil Fertility Section emphasised the dominating influence exerted on the development of soil science by modern economic conditions.

This was also apparent in the Soil Classification and Genesis Section. Hitherto the chief object of

this section has been to establish an objective basis for soil taxonomy, but the principal matter discussed at Oxford was land rather than soil classification. An excellent series of papers described the methods adopted, with special reference to land settlement plans, in the United States, Canada, Germany and Hungary. Aims and methods differ widely in different countries, and are influenced by modern political trends towards national agricultural planning. The results can scarcely be regarded as objective, but they afford an illustration of the way in which an adolescent science may become involved with a transient political economy. That soil science has become a junior and sometimes fortunately forgotten servant of politics is recognised by research workers striving in many countries to make bricks without straw—to produce the practical results demanded of them with insufficient knowledge of the fundamental nature of the soil. Spectacular successes are still occasionally obtained (though none was described at the Congress) by applying the principles of pure chemistry, physics and biology to soil problems, but the field for such successes is narrowing rapidly, and it seems as if the next real step forward in either pure or applied soil science must be awaited until conditions allow research workers to reason out their problems from the beginning instead of from the end. The general impression left by the Congress was that practice has outstepped theory, and that there is little immediate likelihood that the discrepancy between them will be reduced.

The Radio Exhibition at Olympia

A VISIT to this year's Radio Exhibition at Olympia, organised by the Radio Manufacturers' Association, gave the impression that the broadcast receiver industry is at last beginning to outgrow its somewhat hectic childhood days, and is settling down to a policy of steady progress and development. On this occasion, the show was conspicuous by the almost complete absence of those 'epoch-making inventions', which in the past have involved the coining of new and wonderful names and the development of complicated valves, in an attempt to improve what has so often been termed 'perfect' reception.

The receivers exhibited fall approximately into three fairly distinct classes. The first involves the modest set of three or four stages with straight amplification at radio frequencies, at a price ranging from about five guineas. The second class includes the more elaborate supersonic heterodyne receiver, which combines the advantages of greater sensitivity and selectivity, and which in table and console models can be obtained at prices from ten or eleven guineas upwards. The third involves the incorporation of this receiver into the modern radio-gramophone which, in its more ambitious examples, commands a price ranging from twenty-five to well over a hundred guineas. While all these types of receiver have been available in previous years, the present display showed that the designers and manufacturers are overcoming the difficulties, technical and otherwise, which they have hitherto experienced in the mass-

production of a rather complicated piece of radio apparatus. All but the simplest sets now incorporate such features as second-channel suppression, automatic volume control and some device to simplify tuning; while, from the musical listener's point of view, a welcome advance is the incorporation of variable selectivity in the better-class receivers. The general listener is not seriously interested in wavelengths, and to meet this point, it was noticed that there is an increasing tendency on the part of manufacturers to engrave tuning dials with the names of broadcasting stations. While also some firms have made a commendable effort to provide enlarged and improved scales, the indications of which can be read at a glance, in some cases a reminder would appear to be justified to the effect that the ordinary listener is not usually equipped with a pocket magnifying glass. Such a reminder is becoming increasingly necessary now that several receivers are provided with one or two short-wave ranges, in addition to the medium and long-wave ranges. This provision is a welcome addition to this year's sets, and indicates an increased tendency to listen to programmes emanating from stations outside the continent of Europe.

A feature of the exhibition, which is perhaps somewhat significant, was the almost entire absence of any reference to television. One or two firms showed components specially designed for use on ultra-short waves in anticipation of experimenters' requirements, especially when a television service is commenced on

wave-lengths less than ten metres. On the whole, however, it was evident that the industry desires to remove from the minds of the public any tendency to delay the purchase of a new receiver on account of the inauguration of a television service in the future. It is unlikely, of course, that this service will in any way affect the use made of the ordinary set for the reception of sound programmes.

Another noteworthy and very recent development, shown for the first time at a radio exhibition, was a series of midget valves, about two inches or less in length and half-an-inch in diameter. These valves have now been placed on the market and are supplied in patterns of the triode, screen-grid and pentode types, with characteristics comparable with those of ordinary commercial valves. They are of very robust construction and are supplied with neat bases of either bakelite or steatite, the latter being specially suitable for the application of the valves to ultra-short wave working. Valve-holders are also available in either material. The production of these valves has given an impetus to the development of midget receivers, several types of which were displayed at the exhibition. One case is literally a pocket receiver, its dimensions being 6 in. \times 4½ in. \times 1½ in., and its weight 2 lb., complete with all batteries and frame aerial. This set is used with a single telephone receiver and is claimed to have a normal receiving range of 50–100 miles on the medium wave broadcasting band. It is known that such receivers have been in use by police forces for some time; but they have not hitherto been generally available to the public. Another receiver, employing four midget valves, weighs 9 lb., and its dimensions are about 9 in. square by 5 in. deep. This contains its own frame aerial, batteries and loud speaker, and since in size and appearance it is much like a box camera, it offers a new conception of the term 'portable wireless set'.

Readers of NATURE who are interested in obtaining further information on any items mentioned above or other matters covered by the Radio Exhibition will be assisted by reference to the Exhibition numbers of the *Wireless World* or *World Radio* (issues dated August 16 and 23 in each case).

The State of Flowering known as Angiospermy

UNDER this title, Prof. J. McLean Thompson makes a very interesting contribution to current speculations as to the nature of the carpel (Publ. Hartley Bot. Laboratories, No. 12, University Press of Liverpool, 1934). His views are based mainly upon developmental studies and close comparative studies of types within a limited range of affinity. These are sound grounds upon which to base morphological conceptions, and they require careful consideration, even if at first view they run directly counter to many popular conceptions.

The flower is regarded essentially as an axis of limited growth with a potentiality to produce sporogenous tissue. This growth centre earlier was vegetative, and the transition to sporogenous growth activity is indicated by the transitional region of bracteoles, sepals, etc.; similarly, the zone between two types of heterosporous tissue may be marked by carpellary structures bearing anthers; the essential fact is the tendency to bear sporogenous

tissue upon an axial emergence which may take various forms.

A series of monocotyledonous forms with inferior ovaries is studied, with the result that no ground is found in their development for the view that the placenta should be regarded as the ingrowths of the walls of sunken carpels. Rather there is extensive toral growth that gives an ovary wall; on the inner rim of this are outgrowths, of which nutrition is often defective and which may be interchangeably style or staminode.

In the same way, a study of the superior apocarpous gynæcium in the Ranunculaceæ suggests that the follicle is to be regarded as a toral upgrowth, after apical growth of the axis has ceased, which links together several associated primordia of a complex spiral phyllotaxis, primordia which lower on the axis would bear anthers and now are associated in the production of ovules. Similarly, the carpels of the *Ranunculus* flowers are the upper members of orthostichies which lower on the axis are represented by stamens; these upper members are essentially sporogenous, and in their central position bear ovules.

Educational Topics and Events

DR. NICHOLAS MURRAY BUTLER's report for 1934 on the Carnegie Endowment for International Peace, Division of Intercourse and Education, is a very interesting record of extensive and carefully organised propaganda in the United States of America, in Europe, in Latin America and in the Orient. In the United States, the Endowment's doctrine of international co-operation as the normal method of conducting world affairs in lieu of the rule of force finds ready acceptance in universities and in educational circles generally: the difficulty is how to reach the people whose opinions have decisive weight when it comes to divisions in Congress and Senate. The 36 Senators who on January 29, 1935, voted against the ratification of the World Court Protocol, so that the affirmative majority fell short of the requisite two-thirds, prevented their Government, the report points out, from co-operating effectively in an important application of this doctrine—a heavy responsibility. International relations clubs, which are groups of students meeting regularly with a faculty adviser, increased during the year in universities and colleges on the United States by 53, making a total of 523. In addition, the movement extended to high schools, in which more than a hundred clubs have been established. The Endowment co-operates by presenting books and other material with the object of giving that background of facts which will enable students to read more understandingly the international news and exert a wider influence after leaving school and college. Outside the United States, 130 such clubs have been formed during the past four years in 29 countries, among which the only European countries are Bulgaria, Great Britain and Greece. Among publications for which the Endowment is responsible are "International Conciliation" and "L'esprit international". The work of the Division in Europe is conducted from Paris (173 Boulevard St. Germain) by a Directeur-Adjoint with the help of a committee representing Austria, Belgium, France (3), Germany (2), Great Britain (2), Greece, Hungary, Italy (2), Spain and Switzerland.

SCIENCE versus superstition in China has not the news-value of the wars of the war-lords, but it is a conflict of which the issues are probably of far greater moment. A letter from Peiping Union Medical College published in *School and Society* of March 30 gives some idea of the strength of the defensive positions which bar the progress of Western science in that country. Every year a considerable number of natives of China graduate at universities in Europe and America and return to their native land with the object of entering upon the practice of medicine or engineering or whatever other profession they have been qualifying themselves for. Provided they are content to settle in one of the coastal cities, they have every prospect of establishing themselves in lucrative and honourable positions, in which they will have ample scope for demonstrating the value to the community of their newly acquired Western knowledge and training. But once they venture into the interior of China, they find themselves up against the most baffling obstacles. Their attempts to apply scientific methods are met with distrust, contempt and ridicule; a mass of deeply entrenched vested interests is stirred into activity; they find their plans thwarted by intrigues and their young enthusiasm speedily evaporates. For in the majority of cases, such students get their first effective contact with Western ideology when they are already about sixteen years of age and consequently they suffer, on repatriation, from "a basic lack of confidence in the fundamental truth of that which they have learned abroad". There has been little or no common ground between the culture absorbed in childhood and the new culture, with its radically different modes of expression, picked up in the West. For the moment, the situation is not encouraging for those who have striven to provide a nucleus of foreign-trained Chinese with whose help China could learn to help herself.

Science News a Century Ago

Memorial to Watt at Greenock

THE issue of *The Times* of August 24, 1835, reported: "The Committee appointed to conduct the erection of the Watt monument and public library at Greenock have with the approbation of the Provost and magistrates of Greenock, and the most worshipful the Provincial Grand Master for Renfrewshire resolved that the foundation stone of the monument be laid with masonic honours on Tuesday, 25th inst. The mason lodges, corporate bodies and trades desirous of doing honour to the memory of Watt, in his native town, have determined on a public procession and the necessary arrangements are being made."

Fall of the Dent du Midi

ON August 26, 1835, "A considerable portion of the principal peak of the Dent du Midi, one of the great spurs of Mont Blanc, fell with a tremendous crash into a deep and narrow valley situate about a league to the eastward of St. Maurice, on the road to Martigny. An accident of a similar nature occurred in the year 1818 when no less than 400 houses were washed away. In this recent instance the peak in its fall carried with it a glacier, which, filling up

the valley, dammed up the stream which ran through it, until it had acquired sufficient force to drive before it the whole mass of earth and rocks into the bed of the Rhone, the course of which became so completely barred as to dry up all below it, and convert the upper part of its rugged and rocky course into a sort of temporary lake. . . . It was not known that any lives had been lost, but the passage across the Alps by the great Simplon road was for a time cut off. An attempt was immediately begun to reopen the communication by a temporary road, which was to describe a considerable circuit." ("Annual Register".)

The Yaguarundi

"THIS beautiful species of *felina*, known only to naturalists by the description of it by Azara in his travels in South America," it is recorded in *The Times* of August 27, 1835, "has been brought for the first time to this country, and arrived last week in the Louisa Bailey from Guiana. It belonged to Mrs. Alboua, and has been presented by her to the Surrey Zoological Gardens. Its general form and character strongly resemble those of the puma, but having the limbs more slender in proportion to its size, the head more pointed, the strength of the jaws and teeth proportionately less, and the tail one-third of the animal's own length. . . . It is an inhabitant of the deep recesses of the forests of Paraguay and Guiana, climbing trees readily, and preying upon monkeys and small birds, but will boldly attack large quadrupeds. Its possession will form a valuable addition to our knowledge of the history of this genus of animal."

Halley's Comet seen in England

HALLEY'S COMET was first seen in England by Sir James South at Kensington, and then by the Rev. T. J. Hussey at Hayes Rectory. On August 31, 1835, *The Times* contained the following note: "Halley's Comet. Royal Observatory, Greenwich, Aug. 28. At 14h. 7m. 35.6s. mean time, the right ascension of the comet was observed by the five feet equatorial to be 5h. 47m. 42.1s. and declination 24 deg. 25m. 33s. north. It appeared very faint."

The Steamships of Great Britain

THE *Mechanics' Magazine* of August 29, 1835, gave some interesting particulars of the number and size of the steam vessels in Great Britain, and the ports to which they belonged. The figures had been taken from a return recently made to Parliament. The total number of steam vessels registered in Great Britain was 397 with a total tonnage of 36,849 tons. There were 84 steam vessels not registered, and 46 under construction. Of the ports, London was at the head of the list with 98 vessels of 11,785 tons and Glasgow second with 56 vessels of 5,298 tons.

The six largest vessels at the time were: *Monarch* of London, 587 tons; *City of Aberdeen*, 384 tons; *Dundee* of Dundee, 399 tons; *City of Hamburg*, 380 tons; *Perth* of Dundee, 399 tons; *John Bull* of London, 398 tons. The registered tonnage, it was explained, was only about one third of the tonnage by admeasurement; and it was estimated that the aggregate tonnage of the steam vessels of Great Britain was about 100,000 tons. The sailing ship tonnage of Great Britain at this time was probably about 3,000,000 tons.

Societies and Academies

PARIS

Academy of Sciences, July 1 (*C.R.*, 201, 1-104).
 LOUIS BLARINGHEM: The duplication of the flowers of the wallflower (*Cheiranthus Cheiri*). JEAN REY: The energy yield of thermo-compressors. Definitions and values. The efficiency of a thermo-compressor can be defined in six ways, all rational. The values differ, and if the compressor is bought under guarantee, the exact definition of field must be specified. H. GRUYELLE and CHARLES POISSON: The magnetic anomalies of the crystalline massif of Madagascar. The magnetic survey by E. Colin between 1901 and 1906 gave magnetic charts of great complexity due to the presence of anomalies. These are now shown to be very local and are mainly due to the presence of magnetite in certain of the underlying rocks. ANDRÉ CARREL and CHARLES A. LINDBERG: The culture of entire thyroid glands. The thyroid gland, with its epithelial cells, its connective tissue, arteries and veins, continues to live for at least 20-30 days under the conditions described in these experiments. Its structure, the structure and activity of its follicles vary rapidly with the chemical composition and the physical and physico-chemical conditions of the liquid circulating in the vessels. WALTER S. ADAMS was elected *Correspondant* for the Section of Astronomy in succession to the late F. Gonnessiat. PIERRE DAURE: Remarks on the validity of statistical conceptions applied to social phenomena. GARRETT BIRKHOFF: Discrete spaces. RAYMOND JACQUES: Certain systems of partial differential equations. ALFRED ROSENBLATT: The Green's function of a limited domain of Euclidian space of three dimensions. M. KREIN: 'Charged' integral equations. V. BŘEČKA: Multiply monotonic polynomials which deviate least from zero. FRÉDÉRIC ROGER: Some metric applications of the idea of the bilateral contingent. LARS AHLFORS: The type of a Riemann surface. ALBERT TOUSSAINT and MIROSLAV NÉNADOVITCH: Contribution to the study of certain rigid biplane cells of finite span. MAURICE DENIS: Contribution to the experimental study of sustaining wings at large incidences. E. M. ANTONIADI: Recent observations of the planet Mars with the 83 cm. telescope of Meudon observatory. The appearance of Mars shows no great difference from that shown in 1933. Details of the observations are given. FRÉDÉRIC MARGUET: The curve of equal azimuth and its use in navigation. GEORGES ALLARD: Statistical mechanics and the equilibrium of radiation and of matter. ANDRÉ LÉAUTÉ: The measurement of the surface tension of viscous substances such as tars and bitumens. Studies of the capillary tube method, paying special attention to the time necessary to attain equilibrium, one bitumen requiring 360 hours. Discussion of the causes of the large divergences between the results obtained by this and by other methods. CLAUDE CHARMETANT: The electrolysis of nickel and cobalt chlorides in solutions of mixtures of water and ethyl alcohol. HUBERT FORESTIER: Magnetisation at a high temperature of ferromagnetic powders. Powders (precipitated ferrites, oligist) heated to the temperature of the Curie point and cooled in a magnetic field showed residual magnetism. This is now shown to depend on three fundamental factors, strength of the field, fineness of the grains, and the crystalline structure. NICOLAS SZULC: Study of the structure of the electric arc. From the results

of the experiments described it is concluded that the electric arc is divided into two parts: a conducting part where the electrical energy is partly used in producing dissociation of exothermic compounds and the formation of endothermic compounds, and a slightly conducting part where exothermic compounds are formed. HUA-CHIH CHENG and JEAN LECOMTE: The modes of vibration of the 1,2-dihalogen derivatives of ethane. The results tabulated are based on Raman spectra and maxima of infra-red absorption. MICHEL DUFFIEUX: The phosphorescence of nitrogen peroxide. The intensity of the bands of the second positive group of N_2 . STÉPHAN PROCOPIU: The depolarisation of light by colloidal solutions, by crystalline precipitates and by solid deposits on glass. MAURICE LUCAS: The variation of the length of cement as a function of the hygrometric state of the air. The experimental results are given graphically in three curves, showing the change of length as a function of the weight of water absorbed, and as a function of the hygrometric state of the air, and the change of weight as a function of the hygrometric state of the air. JEAN MOLNAR: The physicochemical properties of picric acid in the pH scale. The experimental results can be explained on the hypothesis that picric acid passes through seven molecular forms with changing pH. PIERRE JOLIBOIS and FRANÇOIS OLMER: A new method of catalysis. Application to ammonia. ANDRÉ MICHEL and ANDRÉ GIRARD: Thermomagnetic analysis as a means of proving the existence of weak solid solutions of the oxides of iron. F. BOURION and E. ROUYER: The cryoscopic determination of the total hydration of the ions of magnesium chloride. JEAN BUREAU: The system calcium nitrite, water. Mlle. MARIE FALNSKI: The increase in the rotatory power of mannite by zirconium salts in aqueous solutions. MARCEL PATRY: The telluric acid group. Nomenclatures. T. KARANTASSIS and L. CAPATOS: The complex iodine compounds of divalent germanium. ORESTE MILLER and LÉON PIAUX: The Raman spectra of *meta*- and *para*-dimethylcyclohexane *cis* and *trans* isomers, and of 1,1-dimethylcyclohexane. CONSTANTIN GHEORGHIU and Mlle. LUCIE MANOLESCU. Heteropolar combinations: complex salts of silver and mercury with 2,thio-4-hydroxy-1,2,3,4-tetrahydroquinazoline. CHARLES LAPP: The specific rotatory power of salts of quinine, quinidine, cinchonine and cinchonidine. PAUL BRENNANS and PIERRE LARIVAILLE: Iodo-*m*-nitrophenols. EDMOND BOCQUIER: The existence of a group of large fossil cavities of the Monasterian epoch on the coast of Talmondais (Vendée). V. BABET and RAYMOND FURON: The continental post-Hercynian formations of the west of Africa (western Africa and equatorial Africa). MAURICE GENGE: The bases of the Klippes of Etienne-Encauron, to the north of Sainte-Baume. GEORGES DENIZOT: The successive tectonic phases in the neighbourhood of Marseilles. PIERRE URBAIN: The separation of the various constituents of marls. LOUIS DANGEARD: The black Eocene clays of the Londe forest (Lisieux geological sheet) containing algae belonging to the genus *Botryococcus*. J. LEGENDRE: The maritime mosquito. BORIS EPHRUSSI and G. W. BEADLE: The transplantation of the imago discs in *Drosophila*. LOUIS COTONI and JACQUES POUCHON: The application to antistreptococcal sera of a new method of titration by the neutralisation of the antibodies *in vitro*. RADU CODREANU: Malignant neoplasia in the hæmocœle of Ephemera under the action of *Symbiocladius rhithrogenae*, a Chironomid ectoparasite.

CAPE TOWN

Royal Society of South Africa, June 19. M. RINDL and M. L. SAPIRO: The alkaloids of *Strychnos Henningsii* (3). Isolation of a second crystalline alkaloid. On the basis of a large number of analyses of the crystalline alkaloid isolated both by the authors and by the firm of E. Merck, of Darmstadt, Germany, the formula $C_{22}H_{25}N_2O_4(OCH_3)$ is ascribed to this compound. This formula differs from the one previously suggested. The alkaloid is probably phenolic. The crude alkaloid is accompanied by very small quantities of a second alkaloid, which can be removed by continuous percolation with ether and purified by high vacuum sublimation. Analyses suggest a formula differing from that of the first crystalline alkaloid by an increment of CH_2 . The likelihood is that the two alkaloids are the monomethoxy and dimethoxy derivatives of the same mother substance. There is also evidence of the presence of a third crystalline alkaloid. J. L. B. SMITH: The genus *Tripterodon*, Playfair. The fish *Tripterodon*, the anatomy of which and taxonomic features have hitherto been inadequately studied, has been investigated. Morphologically it appears that it should be included in the family *Platacidae*. J. BURTT DAVY: *Taraxacum magellanicum*, Comm., in South Africa. S. BIESHEUVEL: The nature of temperament. The behaviour qualities grouped together under the heading of temperament have been reduced to three distinct units, for each of which a psychological explanation has been found. The relationship of these fundamental factors to environmental influences and organic processes has been tentatively determined. R. S. ADAMSON: Note on the stem structure of *Boscia rehmanniana*, Pest. The old stems have anomalous secondary thickening with successive extrafascicular cambia. These arise as separate portions and develop tissues both centrifugally and centripetally. The centrifugal growth is much greater than the centripetal.

GENEVA

Society of Physics and Natural History, June 20. M. GYSIN: The copper minerals of Kinsenda (Belgian Congo) (3). On the presence of a hypogene covelline and a supergene covelline. The author describes two varieties of covelline observed in the copper minerals of Kinsenda. The first variety forms lamellar inclusions in bornite, which start from the (100) cleavages to develop in the octohedral (111) directions; it is of hypogene origin. The second variety, of supergene origin, forms large tufts which spread over outside the grains of chalcopyrite and of white chalcocite, following generally the sphenoidal octohedral directions of the two minerals. TH. HILLER: (1) Contribution to the study of opaque minerals by the methods of impressions. Improvement in the technique of electrolytic attack. The author describes a technique for etching electrolytically and then taking a chemical print of the grains of isolated minerals in the gangue. This method allows opaque conducting minerals, completely refractory to ordinary chemical reagents, to be attacked, and shows their principal elements without destroying the specimens. (2) The determination of some linneites of Northern Rhodesia and Katanga by the method of imprints. The author describes the chemical reactions utilised for identifying cobalt and copper in some linneites with polished surface by the method of imprints. The simultaneous presence of

these two elements is a character peculiar to linneite, and this permits its differentiation from a series of optically analogous minerals. P. WENGER, CH. CIMERMANN and MLE. NYSZEWSKA: The micro-estimation of cadmium by means of oxyquinoline.

Forthcoming Events

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

Sunday, August 25

BRITISH MUSEUM (NATURAL HISTORY), at 3 and 4.30.—Miss M. H. Smith: "Fish and Whales".*

IMPERIAL BOTANICAL CONFERENCE, August 27-30. To be held in the rooms of the Linnean Society, Burlington House, London, W.1.

August 28. Sir Arthur Hill: Presidential address.

Official Publications Received

Great Britain and Ireland

London Shellac Research Bureau. Technical Paper No. 3: Fundamental Physical Properties of Lac. Part 1: Mechanical Properties. By Dr. Lal C. Verma. Pp. 38. (London: London Shellac Research Bureau.)

Seale-Hayne Agriculture College: Department of Plant Pathology. Eleventh Annual Report for the Year ending September 30th, 1934. (Pamphlet No. 44.) Pp. 59. (Newton Abbot: Seale-Hayne Agricultural College.)

Force and Youth. By Lord Davies. (New Commonwealth Pamphlets, No. 9.) Pp. 10. (London: The New Commonwealth.) 3d.

Rothamsted Experimental Station, Harpenden. Report for 1934. Pp. 259. (Harpenden: Rothamsted Experimental Station.) 2s. 6d.

Other Countries

Bulletin of the Michigan College of Mining and Technology. New Series, Vol. 8, No. 3: General Information for the Year 1935-1936. Pp. 164. (Houghton, Mich.: Michigan College of Mining and Technology.)

Proceedings of the United States National Museum. Vol. 83, No. 2977: Parasites of Fishes in Galveston Bay. By Asa C. Chandler. Pp. 123-157+plates 6-12. Vol. 83, No. 2978: On the Reptilia of the Kirtland Formation of New Mexico, with Descriptions of New Species of Fossil Turtles. By Charles W. Gilmore. Pp. 159-188+plates 13-18. (Washington, D.C.: Government Printing Office.)

University of Illinois: Engineering Experiment Station. Bulletin No. 270: Laboratory Tests of Three-Span Reinforced Concrete Arch Bridges with Decks on Slender Piers. By Prof. Wilbur M. Wilson and Ralph W. Kluge. Pp. 134. 1 dollar. Bulletin No. 273: Mechanical—Electrical Stress Studies of Porcelain Insulator Bodies. By Prof. Cullen W. Parmelee and Prof. John O. Kraehenbuehl. Pp. 72. 75 cents. (Urbana, Ill.: University of Illinois.)

Baltic Geodetic Commission. Special Publication No. 4: Re-measuring of the Base Lines of Lolland and Öland in the Year 1933. By Ilmari Bonsdorff. Pp. 36. (Helsinki: Baltic Geodetic Commission.)

Suomen Geodeettisen laitoksen julkaisuja. No. 21: Zwei Ausgleichungen des grossen südfinnischen Dreiecksnetz. Von V. R. Ölander. Pp. 66. (Helsinki: Finnischen Geodätischen Institutes.)

The Journal of the Shanghai Science Institute. Section 3, Vol. 2: Bibliographical Introduction to the Study of Chinese Insects. By

Yoshio Ōuchi. (Entomological Report No. 1.) Pp. iii+533. (Shanghai: Kelly and Walsh, Ltd.; Tokyo: Maruzen Co., Ltd.) 5 M. dollars.

Expédition Antarctique Belge. Résultats du voyage de la *Belgica* en 1897-99 sous le commandement de A. de Gerlache de Gomery. Rapports scientifiques. Zoologie—Oligochètes. Par Dr. Léon Cernovitov. Pp. 11. Zoologie—Pycnogonides. Par Dr. Louis Giltay. Pp. 16. Botanique—Observations sur des Algues. Par E. de Wilde-man. Pp. 47. (Bruxelles: Musée Royal d'Histoire Naturelle.)

The Currents in the St. Lawrence Estuary, Ste. Anne des Monts to Father Point, 1932-1933. Pp. 42+3 plates. (Ottawa: Canadian Hydrographic Service.)

Sudan Government. Annual Report of the Gezira Agricultural Research Service for the Year ended 31st December 1934 relating to Experimental Results obtained in the Season 1933-34. Pp. xi+170+14 plates. (Wad Medani: Gezira Agricultural Research Service.)

Department of Agriculture: New South Wales. Science Bulletin, No. 46: Plant Diseases recorded in New South Wales. By Dr. R. J. Noble, H. J. Hynes, F. C. McCleery and W. A. Birmingham. Pp. 47+1 plate. (Sydney: Government Printer.)

Report of the Aeronautical Research Institute, Tōkyō Imperial University. No. 122: On the Wall Interference of a Circular Wind Tunnel. By Kwan-ichi Terazawa. Pp. 75-81. 15 sen. No. 123: On the Smokeless Zone around a Heated Platinum Ribbon. By Syūzō Miyake. Pp. 83-106+7 plates. 40 sen. No. 124: Psychologische Untersuchung über den zeitlichen Verlauf der Einflüsse des niederen Luftdrucks. Von Yenziro Awadi und Tuneso Toyohara. Pp. 107-123. 35 sen. (Tōkyō: Kōgyō Toshō Kabushiki Kaisha.)