# Nature

A WEEKLY

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*"To the solid ground*
*Of Nature trusts the mind that builds for aye."*—WORDSWORTH.



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SATURDAY, JULY 2, 1932


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## River Gauging and Flood Prevention

THE recent floods in the Midlands, with their resultant enormous material damage and, in one or two localities, regrettable loss of life, have again directed public attention to one of the most serious and difficult problems connected with the efficient drainage of inland districts, namely, the regulation of river flow. Rivers, as a class, are notoriously erratic in their behaviour. Sometimes, in seasons of prolonged drought, they scarcely provide sufficient water for the minimum requirements of trade and agriculture; at others, they transform themselves into raging torrents sweeping everything before them in an orgy of havoc and ruin. The control of such violent natural forces is an essential duty of civilised communities, in the interests not only of farming and transport but also of public safety. It is characteristic, however, of British methods, that, hitherto, there has been no properly organised or systematic study of the range and extent of river floods, and no national or authoritative collection of stream-flow data upon which reliance could be placed for a scientific investigation of their incidence. Certain important bodies (few in number), such as the Thames Conservancy, have carefully maintained an efficient service of river gaugings—the records at Teddington Weir are admirable—but, generally speaking, Conservancy Boards have had few or no resources available for expenditure of this kind. It is quite true, also, that, in a number of instances, individual initiative has set on foot the compilation of local data and the taking of observations which, within their limitations, are, no doubt, capable of affording much serviceable information, but these efforts are regrettably

spasmodic, and, unless carried on under supervision of unimpeachable reliability, call for careful scrutiny and independent confirmation.

As an outstanding instance of competent individual enterprise may be instanced the operations during the last few years of the private organisation known as River Flow Records, promoted by Capt. W. N. McClean, who, himself an authority on the subject, has at his own expense maintained a staff of operators to gauge and record the flow of streams in the Ness Basin, Inverness-shire. That the cost of obtaining and collating such records for public service should come out of the pockets of individuals is manifestly unfair, and, indeed, it constitutes a financial burden such as cannot generally be borne, nor, if taken up, can it be sustained for any length of time. The organisation in question was undertaken for the purpose of giving practical illustration of the manner in which gauging records of the principal water areas of Great Britain may be kept, and it has issued a series of quarterly reports giving the readings taken, with a statement of the difficulties encountered and the means by which they were overcome. New bodies, responsible for the carrying out of such duties, will do well to acquaint themselves with the methods employed in connexion with the gauging of the Ness, the Garry, and the Moriston.

Other work, of a collective nature, has been done under the auspices of the leading technical institutions, not strictly confined to the question of flood prevention, since river-flow records are essential to a number of objects: irrigation, transport, water supply, etc. The Institution of Civil Engineers in March 1931 appointed a Committee " to examine the present state of knowledge in regard to the magnitude of floods in relation to reservoir practice in Great Britain and to make recommendations on the best methods of dealing with them in that connexion ". During the past twelve months, this Committee has been pursuing inquiries in order to discover the evidence available, and the information, when published, will undoubtedly be of great value. The Council of the Institution of Water Engineers, in pursuance of a resolution passed at a general meeting of the Institution in December 1927 directing attention to " the urgent need of an organisation which will ensure a continuous record of the flow and storage of surface and underground water ", appointed a Committee on Stream Flow and Underground Water Records. This Committee presented its report to the annual meeting of Dec. 6, 1929, and was reappointed as another Committee on Stream Flow Gauging, authorised, if invited, to act with and assist a Governmental Department Committee on River Gauging which had been formed as a Sub-Committee to the Standing Advisory Committee on Water, comprising representatives of the Ministries of Health, Agriculture, and Transport. After sittings extending over a year, the Government Committee in the autumn of 1931 suspended or curtailed its investigations, on the ground of economy. It took the view that river gauging was a function of the new Catchment Boards set up by the Ministry of Agriculture and Fisheries under the Land Drainage Act of 1930.

Although not specifically laid down in the Act, it is obvious that a systematic determination of the range of flow in each river basin must be a primary duty of the authorities called into existence for the express purpose of coping with problems of land drainage. It is a fundamental consideration in regard to the utility of river-flow measurements that, if these are to afford reliable guidance, they must be continuous and of prolonged duration. Casual readings are quite inadequate for the preparation of plans of river improvement or control. The Committee of the Institution of Water Engineers, previously referred to, has laid it down that records should be carried on continuously for a period of between five and ten years. Most engineers with river experience will agree that the latter limit is not a day too long, and that, even then, there may be substantial variations in comparison with readings over longer periods. But, since in regard to flood prevention it is the exceptional not less than the average experience which is required, and as abnormal events occur only at long intervals, it is obvious that a much more extended range of gaugings is imperative. The memory of the oldest inhabitant of a district will often furnish instances of inundations so greatly exceeding the normal as to tax the credulity of listeners. Not infrequently, of course, there is an element of exaggeration in these recollections, such as can only be eliminated by careful and painstaking investigation. Ordinary members of Catchment Boards, without special knowledge, can scarcely be expected to appreciate the fundamental importance of continuous and prolonged as well as of precise records. It is the duty of their technical officers to emphasise these essential requirements.

A feature of the case which should not be overlooked is the change which is insensibly being brought about by the increasing extent of impervious surface, especially in urban districts, due to the rapid spread of building operations and road construction. The effect of this is to produce an

appreciable augmentation of the run-off immediately after rainfall.

Some of the forty-six new Catchment Boards, with commendable zeal, have realised their responsibilities, and have appointed special staffs to undertake the work of river survey and gauging in their areas. But this cannot be said, as yet, of the majority. It is to be hoped that lack of co-ordination of effort and uniformity of method may not render the results of variable value. As is evidenced by the earnest discussion in the House of Commons on June 15, and the pressure on the Government to provide financial assistance, flood prevention is a matter of urgent and vital importance to the community as a whole. It would be extremely unfortunate if there should be any avoidable delay in starting the preliminary investigations and any failure to pursue them on the right lines.

## The Science of Peace

*The Causes of War: Economic, Industrial, Racial, Religious, Scientific and Political.* By Sir Arthur Salter, Sir J. Arthur Thomson, G. A. Johnston, Alfred Zimmern, C. F. Andrews, Frederick J. Libby, Henry A. Atkinson, Wickham Steed, and others. Edited by Arthur Porritt. Pp. xxix + 235. (London: Macmillan and Co., Ltd., 1932.) 7*s.* 6*d.* net.

ONE of the most significant and hopeful features in the international situation is the growing extent to which, in the last ten years, attention has been directed not merely to the prevention of war by such efforts as the scaling down of armaments and the provision of alternative methods of settling international disputes, but also to the discovery of the underlying causes of international friction and misunderstandings. This is a positive contribution to the building of a new world order, and is akin to the method of inquiry adopted in all scientific investigations. Too often in the past pacifist and politician alike have been superficial in their methods and inquiry, too eager to get a vexed problem out of the way to care whether the so-called solution or settlement was based on definitely ascertained facts impartially considered, or whether, on the contrary, it did not contain the seeds of a future and more dangerous dispute. The machinery for examining and removing the causes of war which the League of Nations has brought into being, and of which its expert committees form such an admirable example, has probably made the greatest contribution towards the establishment of what may be justly termed a science of peace.

No more authoritative discussion of the causes of war has yet appeared than that contained in the Report of Commission I. of the World Conference for International Peace through Religion. The Commission has called to its aid experts in the fields of economics, industry, racial problems, science, politics, etc., and accordingly we have an analysis of the economic causes of war from Sir Arthur Salter; the cultural causes from Prof. Arthur Zimmern, political causes by Mr. Wickham Steed. Industrial and labour influences are discussed by G. A. Johnston, racial influences by C. F. Andrews; André Siegfried contributes a section on the influence of tariffs, and Moritz Bonn one on migration.

Sir J. Arthur Thomson contributes a rather disappointing chapter on "Science and War" which will, we fear, leave many people wondering on which side scientific workers stand in this matter. It is not sufficient to plead that the blame for the use of knowledge for evil purposes lies in our imperfect human nature and not on the science which has evolved the new weapons of war. Discovery should not be blamed for the abuse of inventions based on it, but the scientific worker will be condemned by world opinion if he does not offer some contribution towards showing the way to the control of the forces his discoveries have released. Our present intolerable situation is due to a wholesale disregard of patent facts, to powerful political prejudices, to a widespread ignorance of social and economic relations in the modern world. We need, as Sir Arthur Thomson admits, a science of society, a true science of economics. It is only as scientific research and scientific methods are patiently and honestly applied in these spheres that we can develop adequate world planning of our industrial and economic resources, greater equilibrium between production and consumption and distribution—the absence of which, as both Sir Arthur Salter and Mr. G. A. Johnston insist, is a potential source of international rivalry and conflict. Similarly impartial scientific inquiry forms the only adequate basis for administration wise enough to eliminate the numerous points of friction which such matters as racial relations, religion, tariffs, migration, or national monopolies still present.

The absence of accurate knowledge in the field of racial relations and the power wielded by ignorance and prejudice are a further danger to peace, and Mr. C. F. Andrews' analysis is supported by a weighty recommendation from the Commission for the voluntary study of race relations as they affect world peace and to promote efforts to remove causes

of racial friction. In particular, an appeal is addressed to the universities to undertake a thoroughly impartial and scientific study of race relations, including anthropological, historical, and biological research, with the view of reaching generally accepted conclusions. This in itself would develop a scientific outlook on the future of the human race in reference to population. This appeal is further supported by a statement from Dr. Rabindranath Tagore, who asserts that this great evil of racial prejudice is only to be overcome by the dissemination of accurate scientific knowledge, and that research in the universities and its interpretation to the world by unimpeachable authority is our most vital need.

Honestly applied in these fields, the scientific method may yet prove mightier than the forces released by the prostitution to destructive purposes of its achievements in the mechanical or physical world during the last half-century. Even in the political sphere, accurate knowledge upon international matters, as Mr. H. Wickham Steed points out, is a prime desideratum, and its accumulation and dissemination as the practice of fact-finding in concert or the technique of conference develops should avail to exorcise the spirit of fear or insecurity and distrust which are foremost among the political causes of war. Certain it is that the dispassionate analysis of the causes of war and their appraisement apart from prejudice in the light of reason afford the only method by which wise preventive measures can be evolved and knowledge regain control. It is at least possible that in this field also the calm, serious spirit of science may prove victorious once more, as in the past it has emancipated mankind from the fetters of superstition and ignorance in the fields of religion and disease.

## Laboratory Construction

*Laboratories: their Planning and Fittings.* By Alan E. Munby. With an Historical Introduction by the late Sir Arthur E. Shipley. Second edition. Pp. xix + 224. (London: G. Bell and Sons, Ltd., 1931.) 30*s.* net.

THE first edition of this work was published in 1926, and the second edition follows on similar lines. The section dealing with the needs of biology and geology has been enlarged by twenty pages, and the last section, consisting of a number of plans of recently built laboratories, has been revised; as before, it contains a number of school laboratories, including those at Clifton, Highgate, and Beaumont, and a number of university laboratories, for both physical and biological sciences. The Los Angeles Normal School laboratories, although included in the school section, would seem more properly to be placed in the university division.

The author in his preface says that "there is still no consensus of opinion among scientists as to what the material equipment in fittings and services should be for a given subject, nor has the author succeeded in raising any general interest in this topic". This is scarcely surprising, for every laboratory is in itself something of an experiment. It falls to the lot of but few people to be concerned with the building of more than one or two laboratories, and these have in general to modify their desires, to bring the cost within the limits of the available resources. Nearly every teacher has suffered in the past from some architectural difficulty in his laboratories, and he is usually mainly concerned to avoid the ills of which he knows, often to produce for himself others unforeseen. There is no common pool of experience. Mr. Munby's book is welcome as an attempt to provide something of the sort. For this reason, one might wish that he had dealt more critically with the design of the laboratories which he has given us. A single example will serve to illustrate this point. In Sir Arthur Shipley's pleasant introduction, a plea is, most rightly, made for more intelligent consideration as to the relative position of the lantern and the screen. For ordinary day-to-day routine work the only place for the lantern is on the lecture bench itself, where the teacher, in whatever institution, may be able almost to operate the lantern with one hand and write on the board with the other. Why is it, therefore, that architects almost always contrive to place a window opposite one end of the lecture bench and a door opposite the other? In the Clifton lecture rooms this error has been avoided, but it would be interesting to know whether, in some of the other lecture rooms shown, the architectural arrangements have operated to prevent proper use being made of the lantern.

In some of the school laboratories shown, part of the space is taken up by desks and part by the usual laboratory furniture. The effect of this seems definitely to be a waste of fifty per cent of the room at one time or another. A critical account of how each laboratory is found in practice to fulfil its aims might help to develop that consensus of opinion which is so slow in developing.

In the body of the work it is at times a little difficult, when the author is dealing with general questions, to know whether he has in mind university or school conditions. The schedule of rooms for definite subjects rather suggests that he holds

the view that school science laboratories should be built on much the same lines as those of the universities, with the omission of some of the specialist rooms. It is difficult to agree with this view, and the recent tendency to build school laboratories on rather an elaborate plan, with expensive fittings, is to be deprecated. One could wish that the author would give us a critical analysis of the essential needs of schools, as distinct from universities, with examples of the way in which these have been successfully met. A few examples as to the difference between schools and universities may be mentioned. The ' top hamper ' of the university chemical benches for bottles used in qualitative analysis has no place in schools to-day. Nor are the cupboards under the benches so necessary, except perhaps at the post School Certificate stage. At Rugby, for example, neither drawers nor cupboards are provided in the benches for elementary chemistry. The spaces are there, but they are unenclosed and the contents always open to view. The simplification reduces initial cost, makes supervision simpler and cleaning easier. It is also more than doubtful if in elementary chemical laboratories for schools a special balance room is needed. The conduct of practical work is easier and the costs are reduced if the balances are kept in the laboratory itself.

One of the difficulties under which teachers often labour is that they cannot make full use of the wall space and of the ceiling of their laboratories. Frequently the walls are broken up by the windows, which have been designed more with the view of providing an attractive elevation than with providing what the science teacher needs. Again, they are often plastered and it is sometimes difficult for an active-minded science teacher to fasten to the walls such apparatus as he may from time to time desire to put up. Is there any reason why laboratory walls should be plastered at all ? The Cavendish Laboratory stands as an admirable model in its simplicity and effectiveness, and its walls are unplastered. Similarly, more use could be made of the ceiling if suspension beams, such as are suggested in the Board of Education's recent pamphlet on " Secondary School Buildings ", were used.

The book contains a useful chapter on laboratory services, but the section dealing with electricity is not adequate to the importance of the subject. The legends under Figs. 64 and 65 have obviously become interchanged.

In some instances the author quotes costs, but these all seem to be higher than is necessary if efficiency only is to be considered. At Beaumont it worked out at 1*s.* 9½*d.* per cubic foot, at Clifton 2*s.*, and at Highgate 2*s.* 1*d.* Special circumstances doubtless account for these, but it would not be difficult to show excellent science buildings costing only 1*s.* 4½*d.* per cubic foot. The cost of fittings must vary with the size of the school and the number of laboratories. At Beaumont it was £2900, at Highgate £5563, and at Clifton £7000. For a school of 400-500 boys, four laboratories and a lecture room, with ancillary rooms, ought with reasonable care to be provided with the mere furniture for something like £1500. In these times of financial stress, those about to build laboratories should not therefore feel unduly despondent if the figures given by the author seem beyond their resources.

## Life and Logic

(1) *The Emergence of Life : being a Treatise on Mathematical Philosophy and Symbolic Logic by which a New Theory of Space and Time is Evolved.* By John Butler Burke. Pp. ix + 396. (London : Oxford University Press, 1931.) 30*s.* net.

(2) *The Mystery of Life.* By John Butler Burke. (The Library of New Ideas, No. 5. Pp. 160. (London : Elkin Mathews and Marrot, Ltd., 1931.) 3*s.* 6*d.* net.

WHEN one leans over the infinite, speech appears a rather embarrassing means of conveying to others the volcanic impetus of one's intuitions. Yet, is it not a privilege of the philosopher to attempt a faithful translation of this unique experience ? So long as he respects the steady parallelism between facts and their expression, he is allowed to enlist the help of analogy and mathematical symbolism in his errand of spiritual charity. But woe to him if he yields to the charm of his endeavours, and allows himself to be carried by his symbols further than the brutal facts permit. Though he need not fear a violent end as a reward for his exaggerations, he may be liable to suffer the more dreadful penalty of seeing his theories universally dismissed as being castles in the air.

Mr. Burke has taken considerable risks in leaning over the infinite and in trying to record for us the impressions of his vision. During twenty years he has had time to ponder over the maze of difficulties set to human wit by matter, life, and mind ; and now he has the courage of proclaiming to the world the solution of the discouraging puzzles invented by the rational genius of the Greeks. Mr. Burke has already made a first attempt, in 1906, when he proposed the view, in his " Origin of Life ", that

some kind of living organism is the primordial element, and that inanimate matter is only the result of the decay of living matter. But he was not satisfied himself with the purely experimental side of his theory, and now he comes back to it armed with the compelling weapons of mathematical logic and symbolism. His fundamental method is the application of Leibniz's ideal of a 'universal characteristic', as actualised by Boole's logical algebra, to Hegel's metaphysics; with the result that he obtains a more complex Leibnizianism which suggests also a novel interpretation of Plato's central theory of ideas. The most notable extension of Leibniz's system is that Mr. Burke rejects the principle of pre-established harmony, and explains the interaction between the monads by what he calls 'time-waves' or scintillation of groups of monads in time, which account for the phenomena of living matter, its growth, reproduction, and hereditary transmission.

Mr. Burke emphatically declares that there is not substance but mind. Following Ostwald, who had already destroyed matter for the benefit of energy centred in points in space, he carries these centres of energy further: so they become centres of mind-stuff, or ideas potentially or actually self-conscious, and, in the limit, ideas in that Mind which conceives and animates it all. These self-conscious units or monads are realities apparently independent of each other. The evolution of life and mind from 'so-called' inorganic matter, in the remote past, is then reconciled with the theory that physical and chemical atoms are systems of such monads. Among these 'atoms' Mr. Burke allows a certain amount of natural selection, illustrated by the survival of stable forms or groups, or the sifting of those types which can manifest and propagate in an efficient manner the characteristic properties of life. The vital principle in organic and inorganic matter is then to be sought in this variation in the atoms of the organism.

The manner in which such variation may arise and be followed up—that is, the evolution of the nebular and spiral atoms in the various stages of condensation, from the primordial substance of mind-stuff to the structure of highly developed mind—is explained in great detail in "The Emergence of Life", after an interesting discussion of the necessary logical and methodological prolegomena, such as algebraic analysis, existential propositions, certainty and probability, induction and analogy. "The Mystery of Life" gives an interesting summary of these views, with some additional comments on their philosophical bearings.

The question whether Mr. Burke's stimulating views carry with them a universal conviction will have to be left open. There is no doubt, however, that they deserve a careful study, in so far as they indicate a possible method of approach to the problems of matter, life, and mind. Though he makes a legitimate use of mathematics and logical symbolism, his analogies seem to be sometimes far-fetched, as, for example, when he suggests that the conjunction of two imaginary notions may yield a real idea, as is the case with two complex numbers. But perhaps this difficulty is due to the fact that the metaphysical interpretation of the complex numbers and their operations is not yet definitely settled. Again, one might be tempted to dispute the truth of Mr. Burke's initial principle that the primordial substance accounts by itself for the existence and evolution of matter, organic and inorganic. Even a matter of years could not show us whether this dogmatic assertion is an arbitrary assumption or not. But here the wider ground of speculative philosophy is safer for Mr. Burke than that of natural philosophy with its restrictions in space and time; for, as he says himself, if life on earth will last for yet a thousand million years, it is not unlikely that man may yet realise the purpose of his existence, while memory holds a seat in this distracted globe. We may outlive our present knowledge in beauty, in growth, and in strength, in worlds more real though now unknown, but not unknowable in the æons that are yet to come. T. GREENWOOD.

## Agriculture and National Prosperity

*Fertilizers and Food Production on Arable and Grass Land.* By Sir Frederick Keeble. Pp. xi + 196. (London: Oxford University Press, 1932.) 5*s*. net.

THE nation is at least alive to the deplorable plight of the agricultural industry in Great Britain. This awareness is undoubtedly penetrating deeply, and there is a growing desire to be informed as to the facts—and the facts of agriculture are singularly intricate and involved. The hard truth, however, remains, that a sound agricultural policy can only be built with bricks and mortar that have themselves been constructed by capable workmen possessed of the necessary knowledge.

To marshal an immense amount of information fundamental to a proper understanding of the agricultural potentialities of Great Britain, and to weld the evidence from innumerable experiments and extensive trials into a concrete and highly sug-

gestive story of less than 200 pages, is indeed a signal achievement. This is what Sir Frederick Keeble has accomplished in the little book before us. It is true that Sir Frederick is here only concerned with the production aspect of the general problem. What does the country produce ? And what could the country produce ? These are the questions which in effect Sir Frederick has set himself to answer. In the last resort, however, policy must be based on sound economic production, and to-day sound economic production must to a very large degree be determined by the skill with which artificial fertilisers are employed.

There is no gainsaying that the farmers of Great Britain as a whole are not making a sufficiently abundant or a sufficiently well-informed use of fertilisers. Thus, as Sir Frederick pointedly remarks, although the acreage under pasturage has been considerably increased during the past sixty years, the grasslands of the country are carrying few if any more live stock. Indeed, the picture which Sir Frederick is compelled to paint in the opening chapters of his book is a sombre one: thousands upon thousands of acres needing drainage, scores upon scores of fields without facilities for watering, and whole districts in need of lime. It is, however, when the results of experiments and records are considered that we are made to realise that the present gloom and depression is by no means inexorable. In dealing with experimental evidence, Sir Frederick Keeble has in the main confined himself to the results obtained from the extensive investigations undertaken at the Jealott's Hill Agricultural Research Station and from the trials conducted in the counties and overseas under the auspices of the research staff of the Station.

All this research is of itself of great intrinsic importance, and has an added value not only because it has been unusually far-flung, but also because it has been conducted with absolutely definite economic ends in view, and the whole undertaking has been in no wise hindered by undue adherence to orthodox opinions. It is stimulating and suggestive to find the problem of the soil and of fertility being dealt with essentially from the biological point of view. " Crop, soil and soil micro-organisms ", Sir Frederick insists, " must need be investigated simultaneously," and with characteristic vision he adds, " a great task fraught with great issues for the welfare of mankind."

As is only to be expected in the case of a book dealing with such a wide range of issues and with the interpretation to be put on so large a number of inter-related phenomena, there are points of detail concerning which we might join issue with the author ; points which for the most part, however, are still under investigation both at Jealott's Hill and elsewhere. It is probable, for example, that less than justice is done to ordinary moderate grassland which is reasonably well managed and which has a high clover content. Thus in Chart III., on p. 43, comparison is made between the " oat crop ", " ordinary grass cut for hay ", and " intensive pasture grass ". Certain types of clovery pasture, although more or less extensively managed, would of course stand comparison with the " intensive " grass altogether better than would " ordinary grass cut for hay ". The virtues of clovery grass are not, however, ignored, and the suggestions made for the rotational (in the annual sense) cropping of grassland (pp. 121-124) are of the highest importance and of far-reaching significance.

The value of the book is much enhanced by the excellent charts, abundant and well-arranged tables, and carefully prepared appendixes.

## Short Reviews

*Fundamental Experiments in Chemistry : a Handbook for Teachers and Students ; Lecture and Class Experiments to establish Chemical Laws and to confirm the Atomic Theory.* By E. D. Goddard. Pp. xii + 147. (London : Ginn and Co., Ltd., n.d.) 3*s.* 6*d.*

THIS little handbook, evidently the outcome of long experience in teaching young students, is primarily intended for science masters in secondary schools. It includes a well-selected and well-arranged collection of lecture and class experiments designed to establish the laws of chemistry and to confirm the atomic theory. By actually doing some of these and having others demonstrated to them, students should obtain a clearer conception of the fundamentals of chemistry than they could derive from a mere recitation of the evidence adduced by the pioneers and the more recent advances by later research workers.

The author gives a description of the experiments and methods he has found successful in presenting such matters as the density of gases and the volume composition of water, hydrogen chloride, ammonia, the oxides of carbon, nitrous oxide, and ozone to classes of boys. Appended to each experiment is a series of notes giving special hints and indicating necessary precautions or variations that are admissible. Another valuable feature of the book is that the results actually obtained by the students themselves are used as examples to illustrate the experiments and the working out of the results. Like the author, the reviewer has found it a good plan to summarise all the results of the students, since, at the conclusion, they are invited to indicate which results should be omitted when the average result

is being found. It is remarkable that the average result for the whole class is usually surprisingly near to the correct one.

Science masters and others will find Mr. Goddard's book useful, if only on account of the number of interesting little points and suggestions he makes in connexion with each experiment. J. G. F. D.

*Handbuch der physikalischen und technischen Mechanik.* Herausgegeben von Prof. Dr. F. Auerbach und Prof. Dr. W. Hort. Band 1: *Technische und physikalische Mechanik starrer Systeme*, Teil 1. Lieferung 1. Pp. ix+306. Lieferung 2. Pp. viii+307-694. Lieferung 3. Pp. 695-787+xviii. Band 1, vollständig, 80 gold marks. Band 2: *Technische und physikalische Mechanik starrer Systeme*, Teil 2. Lieferung 1. Pp. viii+404. Lieferung 2. Pp. xiv+405-673. Band 2, vollständig, 75 gold marks. (Leipzig: Johann Ambrosius Barth, 1927–1930.)

DURING the years 1890 to 1896 Winkelmann published a famous handbook on physics, which reappeared in a new edition in the years 1901 to 1909. When, about six years ago, a third edition was called for, the growth of material to be treated led to the division of the single handbook into a series of handbooks, each dealing with different domains, under separate editors. Among their subjects are electricity and magnetism, physical optics, and mechanics (physical and technical). The last of these, which is the subject of this brief notice, comprises seven volumes, some of them divided into parts separately published (these cannot be separately purchased, each volume being sold as a whole). Some part of each volume has appeared, and some volumes, but not all, are complete. The work is remarkable in its scope, and is well printed and illustrated. Probably few individual teachers or students could afford to possess a copy of so large a work, which is necessarily expensive, but in scientific libraries, whether academic or industrial, it deserves a place. Its great merit is that it brings together, in an easily accessible and assimilable form, a large body of scattered knowledge on mechanics, together with references to sources of fuller information. The first two volumes deal with the general principles and main results in kinematics, dynamics and statics, and mechanism, and conclude with an interesting account of physiological (including human) mechanics and mechanism.

*The Mysterious Universe.* By Sir James Jeans. Second edition. Pp. ix+142+2 plates. (Cambridge: At the University Press, 1931.) 2*s*. net.

IN the second edition of this well-known book, the author explains that he has found with regret that certain passages in the original book were liable to be misunderstood, misinterpreted, and even misquoted, in various unexpected ways. He has expunged some of these passages and re-written or amplified others. Here and there new paragraphs, occasionally even whole passages, have been added in the hope of making the argument clearer. The main line of thought, however, is unchanged, and needs no comment. The opportunity has also been taken of correcting certain misprints and errors in the first edition. It is a pity that this was not carried out more thoroughly. We still have, for example, the ambiguous "this" on p. 38, line 11; the miscalculation on p. 84; the singular noun and plural verb at the top of p. 134; and the statement (p. 49) that Maxwell had "shewn" (instead of "predicted") and Lebedew had "measured" (instead of "observed") the pressure of radiation. One of the newly introduced paragraphs, in fact, contains the misstatement (p. 119) that Kepler believed in the truth of his "five solids" law "for one brief moment". Criticism of details to the neglect of the whole is admittedly reprehensible, but insufficient care in verifying details, especially in a second edition, is nevertheless to be regretted. The paper and printing of the new edition are in no way inferior to those of the old, despite the reduction in price.

*Dimensional Analysis.* By Prof. P. W. Bridgman. Revised edition. Pp. vi+113. (New Haven, Conn.: Yale University Press; London: Oxford University Press, 1931.) 24*s*. net.

THE second edition of Prof. Bridgman's well-known book differs very little from the first. A few minor errors are corrected, and references are given to the writings of certain other authors that have appeared in the interval. Though these are strongly critical of Prof. Bridgman's doctrines, he sees no reason to change his opinions; he prefers, therefore, not to enter into controversy, but to leave his readers to judge between him and his critics. This procedure is entirely creditable to Prof. Bridgman, and certainly preferable to an attempt to expound views with which he has no sympathy. But the whole position is not creditable to science. The differences that divide Prof. Bridgman from his critics are not matters of opinion; they concern the validity of certain quite simple logical arguments; one side in the dispute must be definitely right and the other definitely wrong. Let us hope that the appearance of this reprint will encourage impartial examination of the controversy and lead to the final establishment of the truth. N. R. C.

*Quanta et chimie.* Par Prof. Arthur Haas. Traduit de l'allemand par Jeanne Perrenot et F. Esclangon. Pp. v+69. (Paris: Gauthier-Villars et Cie, 1931.) 15 francs.

THE scope of this little work, based on four lectures, is, as explained in the author's preface, to present, as simply and shortly as possible, quantum physical theory having an interest to chemists, and avoiding any use of mathematics. As the limitations imposed by these conditions indicate, the book is a résumé of the position (in 1929), popular only to the extent of being written for the non-specialising scientific worker. The four chapters deal with the arithmetic of chemical periodicity, the quantum theory of valency and chemical forces, electron grouping and the periodic system, and the quantum problem of molecular and nuclear structure. An English version has appeared under the title of "Quantum Chemistry". N. M. B.

## World Structure and the Expansion of the Universe*

By Prof. E. A. MILNE, F.R.S.

THE most distant nebulæ appear to be receding from us, and the velocity of recession is proportional to the distance. The most commonly accepted explanation of this phenomenon is that due to Friedman and Lemaître. The principle of their explanation is that it is possible to describe the observed facts by assigning fixed co-ordinates to a distant nebula in a curved space-time in which the metric involves the time $t$. The spatial interval-distance between the nebula and the observer is then a function of $t$. The difficulties of this explanation are (1) that it involves the existence of 'cosmic time' and restores the distinction between time and space abolished by Minkowski; (2) that it has been impossible to explain why 'space' is expanding and not contracting. This theory is a development of the remarkable pioneer theories of Einstein and de Sitter, which contemplated static metrics for space-time. De Sitter's world, it is true, placed time on the same footing as space, but Einstein's cylindrical world introduced "cosmic time". More recently (*Proc. Nat. Acad. Sci.*, **18**, 213; 1932), Einstein and de Sitter have concluded that at the present moment it is impossible to determine the algebraic sign of the curvature of 'space', and that the facts of observation can be described by assigning fixed co-ordinates to a distant nebula in a quasi-Euclidean space expanding with the time.

A much simpler explanation of the facts may be obtained as follows. The explanation abandons the curvature of space and the notion of expanding space, and regards the observed motions of distant nebulæ as their actual motions in Euclidean space.

Consider a spherical region of Euclidean space, occupied at time $t=0$ by a uniform spatial distribution of moving particles, moving in random directions with velocities $u$, $v$, $w$, distributed according to a law $f(u, v, w)\,du\,dv\,dw$. The density is supposed to be so small that collisions do not occur and forces of interaction are supposed negligible. Outside the sphere (say of radius $r_0$) let space be empty. Then the *outward* moving particles will move into the empty space outside and the faster particles will gain on the slower. At any time $t$ the fastest moving particles will form an expanding spherical frontier, followed by the next fastest, and so on. The *inward* moving particles will traverse the sphere of radius $r_0$, emerge at the other side, and then move outwards. Thus at any sufficiently large time $t$ all the particles moving with a given speed $V$ will be found between the spheres of radii $Vt-r_0$ and $Vt+r_0$. We see at once that after the lapse of sufficient time, all the distant particles will have velocities of recession; and the mean velocity of recession at any distant point will be ultimately proportional to the distance, the constant of proportionality being simply $1/t$. The interior of the original sphere, and indeed all space inside the distant moving portion, remain occupied throughout. For example, near the centre of the original sphere, after a long time $t$ only slow-moving particles will be found, namely, those which started inwards from the original frontier with sufficiently small velocities. The density everywhere decreases with the time, and the particles sort themselves out in velocity, the sorting becoming more perfect the larger the velocity.

Clearly the restriction to an initially uniformly occupied sphere is unnecessary. Any initial density distribution which decreases sufficiently rapidly with distance will give rise to the same effect. This is true even if the initial distribution fills infinite space. The only difference is that *every* small element of volume always contains a few slow-moving particles, even after a long time; but the sorting goes on. The essential aspect of the situation is that we are dealing with an unenclosed system.

The above explanation is applicable at once to the system of nebulæ. The fastest moving ones will have velocities exceeding the velocity of escape against gravity, and will ultimately pursue curves indistinguishable from their linear asymptotes.

This common-sense explanation has many advantages in addition to that of rendering unnecessary the introduction of a curved 'space' and a non-static metric. It shows at once that the system is necessarily an expanding system after a sufficiently long time. If at any instant all the velocities are imagined to be reversed in direction, the system appears to contract to its configuration at time $t=0$ and then expands again. Moreover, if at time $t=0$ all the velocities are reversed, the system still expands. The instant $t=0$ affords a natural origin of time for the observer recording the distribution-laws. From this instant evolution proceeds in an inevitable direction, namely, in the direction of expansion. We may say that creation and uni-directional evolution are brought into a single mathematical scheme.

It is quite unnecessary, however, to introduce a 'cosmic time'. Let an observer count the particles with velocities inside the range $u$ to $u+du$, $v$ to $v+dv$, $w$ to $w+dw$, and arrive at the law $f(u, v, w)\,du\,dv\,dw$. Let a second observer, moving with uniform velocity $V_0$ with respect to the first, make a similar enumeration, and suppose he arrives at the law $f_1(u, v, w)\,du\,dv\,dw$. We may inquire what must be the actual distribution-law in any frame so that $f \equiv f_1$, that is, so that the velocity-pictures of the universe recorded by the two observers are identical. Neglecting the curvatures

* Synopsis of a paper read at a colloquium at Wadham College, Oxford, on June 7, 1932.

of the paths, we find that the distribution-law must be

$$\frac{B\,c\,du\,dv\,dw}{(c^2-u^2-v^2-w^2)^2}$$

where $B$ is a pure number and $c$ is the velocity of light. This permits a continuous distribution of velocities up to $c$. Since actual recession speeds have been recorded up to one-fifteenth of that of light (19,700 km./sec., see Humason, *Mt. Wilson Contributions*, No. 426, 1931), and since still higher velocities may be expected, there seems nothing fantastic about this distribution-law.

Suppose now two observers start at the centre $x=0$, $y=0$, $z=0$ of the initial spherically symmetrical distribution at time $t=0$, with relative velocity $V_0$ with respect to one another. We may inquire what must be the spatial distribution of particles such that the universe will for ever appear the same to each observer. This requires a more complicated analysis, for the two observers will disagree as to what is meant by simultaneity. To solve this problem it is necessary to introduce the concept of the intensity $I$ of world-lines at a point in time-space in a given direction. This is defined as the number of world-lines per unit solid angle in 4-space per unit 3-space cross section normal to the direction of the world lines. The conditions that any proposed function $I=F(x, y, z, u, v, w, t)$ shall represent a concourse of permanent objects are that (1) $F$ shall be invariant for a Lorentz transformation, (2) $F$ shall be constant along a world-line; the second condition is readily shown to be equivalent to the satisfaction of Boltzmann's equation in gas-kinetic theory. When $F$ is determined and we return to the co-ordinates $x$, $y$, $z$, $t$ of any particular observer measured from the natural origin of time-space, the distribution law is found to be

$$\frac{c^2\,A\,du\,dv\,dw\,dx\,dy\,dz}{(c^2-\Sigma u^2)[(c^2t-\Sigma ux)^2-(c^2t^2-\Sigma x^2)(c^2-\Sigma u^2)]^{\frac{3}{2}}}$$

which may also be written in the form

$$\frac{c^2\,A\,du\,dv\,dw\,dx\,dy\,dz}{(c^2-\Sigma u^2)[c^2\Sigma(x-ut)^2-\Sigma\{v(z-wt)-w(y-vt)\}^2]^{\frac{3}{2}}}$$

This shows at once that for given $x^2+y^2+z^2$ and given $u^2+v^2+w^2$, the density is a maximum (for sufficiently large $t$) when $u:v:w=x:y:z$, that is, it gives the recession predominance. It also gives the velocity-distance correlation for $t$ large. Integrated over the complete spatial solid-angle for 3-space it gives for time $t=0$ the distribution-law

$$\frac{4\pi c\,A\,du\,dv\,dw}{(c^2-\Sigma u^2)^2}\cdot\frac{dr}{r}$$

showing that the density-distribution at any time $t$ may be derived as the natural expansion of an initial distribution* with a density law $\rho\propto 1/r^3$. This of course gives a congestion of matter at the origin at time $t=0$, and expanding spheres of singularities at any other time. This in turn shows that it is necessary to introduce gravitation and so curvature of world-lines as a second approximation. But the density law $\rho\propto 1/r^3$ gives a gravitational potential tending to a constant at large distances, and so preserves the analysis as representing the uniform rectilinear motions at great distances. Presumably a Gaussian metric is required for the vicinity of the space-time origin, but it tends to the Galileian form at great distances.

According to these very elementary considerations, which only involve the principles of the special theory of relativity, the continuum of time-space is occupied at large distances from the natural space-time origin by a hyper-complex of world-lines having spherical symmetry about the space-time origin. There is no such thing as cosmic time. But at each point of space-time there is a unique direction in which the space-time origin lies. Every observer sees the same velocity distribution at great distances. Every observer can regard himself as the centre of the universe by choosing his time axis so as to point away from the time-space origin—in other words, by choosing the motion of his frame of reference so that it is at rest with respect to the vector average of the motions in his immediate neighbourhood. The world is then perfectly ego-centric at all points, and the moving picture of the world as made by any one observer is identical with that made by any other observer.

The principle of relativity in its original form asserted that all frames of reference are equivalent for the description of the *laws* of Nature. The foregoing ideas rest on an extension of the principle to the assertion that the world itself, when local irregularities are disregarded, must appear to have the same structure to all observers; in other words, the principle of relativity is extended from the *laws* of Nature to the *phenomena* occurring in Nature.

We cannot observe space. We observe point-events. But we can recognise the continued existence of material objects, and hence we can arrange these observed point-events in world-lines. It seems best to avoid the phrase 'the structure of space' or of 'space-time', and consider simply the structure of the hyper-complex of world-lines which can be reconstructed from our observations. The preceding analysis discusses the simplest ideal system of world-lines that is compatible with the observed permanence of material objects and satisfies the extended principle of relativity. It is not difficult to generalise the analysis so as to describe a hyper-complex of curved world-lines and to connect the distribution of intensity with the distribution of curvature, and thus to make some progress towards the introduction of gravitation even inside the limits of Galileian space-time. But these developments are deferred to another occasion. I conclude by emphasising the very simple explanation of the expansion of the universe of material objects obtained by examining the kinematics of an unenclosed system with central condensation.

* For $t=0$, the last formula gives the distribution *between* the radii $r$ and $r+dr$. But at $t=0$, at any given *point* $r$, the velocities are predominantly tangential.

## Three Arctic Expeditions in 1931

IN the summer of 1931, three expeditions using very different equipment visited adjacent regions of the arctic, and Prof. H. U. Sverdrup has summarised the preliminary results obtained and compared the usefulness and prospects of the different methods employed.* The Swedish-Norwegian party under the leadership of Prof. H. W:son Ahlmann relied upon the old proved technique and carried out oceanographical work from the *Quest* in the neighbourhood of Franz Josef Land and Spitsbergen (North-East Land) together with dog and sledge journeys across North-East Land, which was shown not to be covered with a continuous ice sheet as formerly believed, but to be divided into two ice areas by a broad ice-free valley. Large geological and botanical collections were made, and the study of these and of the meteorological and oceanographical observations is proceeding.

The other expeditions with submarine and airship were financed by the Press, and for this reason and on account of the novel means employed, they received wide publicity. An American Press magnate who was interested in Wilkins's submarine (*Nautilus*) project had offered to finance the Zeppelin flight on the understanding that the air-ship should attempt to establish contact with the submarine near the north pole, but when the *Nautilus* was delayed by an unlucky Atlantic crossing, this plan had to be abandoned and the support for the flight was not forthcoming. Fortunately the commander, Dr. Eckener, was able to come to a favourable understanding with the German Press, and although the original plans developed by Nansen of a flight across the pole could not be entertained, a cruise to Franz Josef Land and to Nicholas II. Land off northern Siberia was successfully accomplished.

* *Naturen*, 1932, p. 86.

The Zeppelin trip from Leningrad only occupied four days. At Franz Josef Land the airship descended to the water and exchanged mails with the Russian ice-breaker *Malgyin*, and this—the first ' landing ' to be made without ground parties —demonstrated the usefulness of the ship as a transport vessel to uninhabited regions. One of the unknown dangers of the expedition was the possibility that ice would be precipitated from the clouds on to the great envelope of the airship and force it down, but this was not realised, because throughout the cruise the temperature of the air passed through was above 0° C., being higher at 1000 m. than at the earth's surface. This temperature inversion, well known to exist in winter, Prof. Sverdrup thinks, may not always obtain in summer, and he anticipates different conditions in the Atlantic quadrant of the polar area from those over the Siberian and Alaskan quadrants, and issues a warning against generalising from this limited experience.

FIG. 1.—Panorama of the Taimyr Peninsula. The shadow of the *Graf Zeppelin* is seen near the middle of the right half of the picture.

For the first time, radio *ballons-sondes* devised by the Russian meteorologist Moltschanof were used to obtain observations of the upper atmosphere. These balloons are equipped with small radio-transmitters sending out signals from which temperature and humidity values are obtained for different altitudes, thus furnishing instantaneous records in regions where there is little hope of the recovery of instruments. Four balloons were dispatched, of which three reached an altitude of more than 16 km., and it was found that at about lat. 80° the temperature of the stratosphere (with its base at 10·4 km.) was −50° C. In summer the average height of the stratosphere in Europe is 11 km. The *Maud* expedition in the spring months obtained a value of 8·5 km. north of Siberia, and Prof. Sverdrup suggests that whereas in general the

height of the stratosphere falls off from the equator to the pole, its minimum altitude, which may be styled the meteorological north pole, does not coincide with the geographical pole but lies between it and Siberia and Alaska. Photographs were taken which will be of assistance in improving the maps of Novaya Zemlya and Franz Josef Land, and it was discovered that Nicholas II. Land is divided into two by a broad strait which has now been mapped on the ground by the Russian geologist, N. N. Ourvantzev.

The good fortune which followed the Ahlmann and Eckener expeditions was denied to Wilkins's submarine venture, in which Prof. Sverdrup himself took part. On reaching the pack ice north of Spitsbergen, it was found impossible to dive, on account of the loss of the vertical rudder: the main project—to test the feasibility of navigation under the ice—was unfulfilled, and instead of a submarine the explorers found themselves in a ship very unfitted for ice work. Nevertheless, a large number of echo soundings and a series of gravity measurements were made, oceanographic stations established, and bottom samples brought up from depths down to 3500 m. From the character of the deeper water, further evidence was obtained in support of Nansen's deduction that the submarine ridge trending north-west from Spitsbergen descends to 1500 m. between Spitsbergen and Greenland.

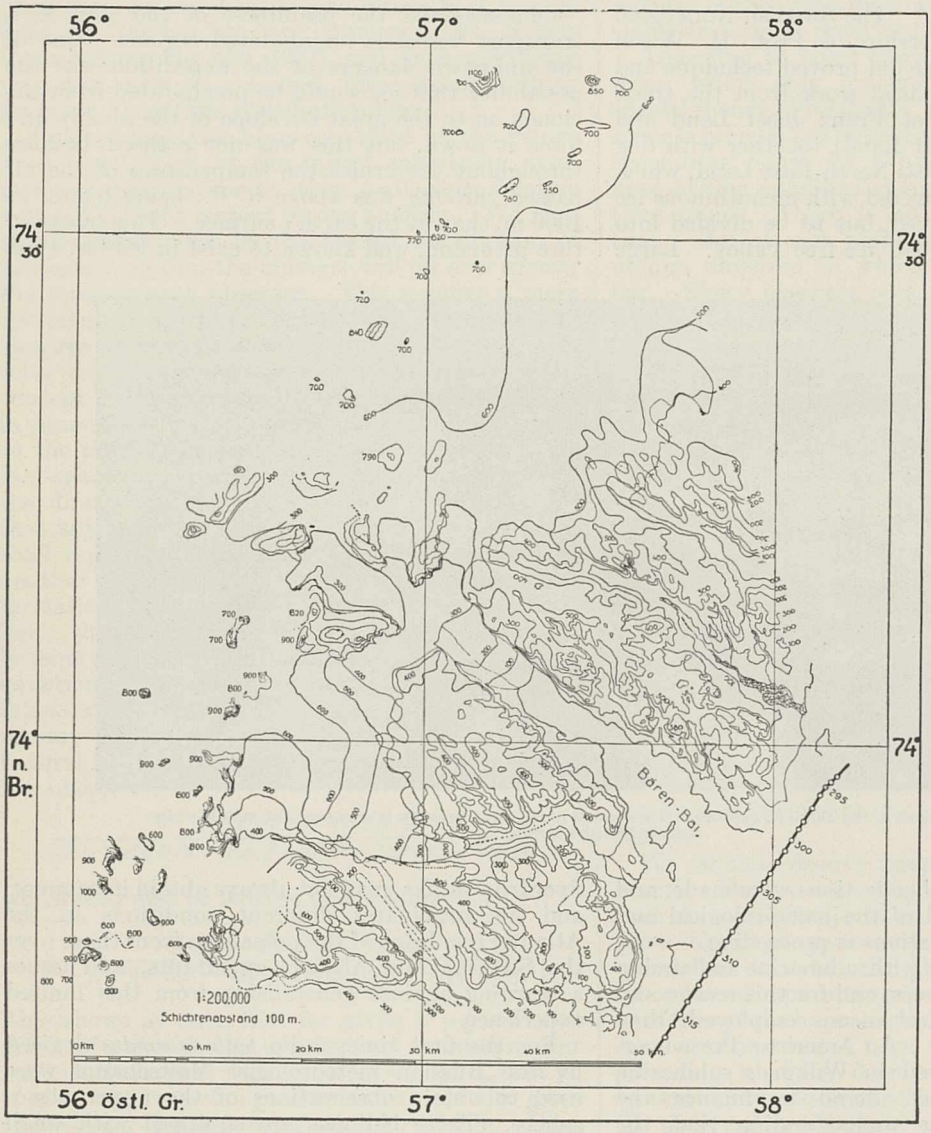


FIG. 2.—Map of part of south-east Novaya Zemlya made from the *Graf Zeppelin* survey.

The conclusion is reached that the old polar technique still maintains its superiority, for there is no doubt that when the results are worked out, those of the Ahlmann expedition will prove the richest; but the airship has definitely 'arrived' and one can confidently anticipate further developments of its usefulness in this field of exploration. Judgment cannot yet be passed upon the submarine—a better boat than the *Nautilus* must be available—but Prof. Sverdrup is of the opinion that "the U-boat will prove the ideal means of travel across the polar sea in summer, and that with the U-boat it will be possible to obtain full knowledge of the oceanography of the Arctic".

A description of the photographic apparatus carried by the *Graf Zeppelin* and an account of the methods employed in the preparation and orientation of maps based upon the photographs has been given by Otto V. Gruber,* from whose paper the accompanying illustrations are produced by courtesy of Messrs. Carl Zeiss, Ltd. The general procedure is similar to that which is adopted in aeroplane photogrammetric surveys. One of the addi-

* "Über die photogrammetrische Ausrüstung des *Graf Zeppelin* auf der Arktisfahrt 1931 und die Auswertungsmethoden für das gewonnene photogrammetrische Beobachtungsmaterial." *Bildmessung und Luftbildwesen*, No. 4, 1931. (Liebenwerda, Sachsen: R. Reiss G.m.b.H.)

tional advantages of operating from an airship is that under favourable conditions the shadow of the vessel appears on the photographs (Fig. 1), thus providing a control over the orientation and scale of the map.

As an example of what can be accomplished by airship survey, we reproduce the map (Fig. 2) of a part of south-eastern Novaya Zemlya showing the coastal region and the inland ice. The map is on the scale of 1/200,000 with contours at 100 m. intervals, and the errors in scale and height are stated not to exceed 10 per cent—probably not 5 per cent. The latitude and longitude may be as much as 1° out, and to correct this it would be necessary to determine by astronomical methods on the ground the true position of some point identifiable on the photographs, or to extend these to include some known point. L. H.

## Obituary

### SIR DORABJI TATA

IN the memorial to his wife which he settled shortly before his death on June 4, Sir Dorabji Tata described himself as "The Last of his House". That is painfully true; with his passing an end comes to a family which played a great part in the intellectual and industrial renaissance of India.

Dorab Tata's rôle in this was that of the executor rather than the creator. The pioneering was done by his father, Jamsetji Tata. Having founded the family fortune firmly by establishing a prosperous cotton-spinning business, he bent his adventurous talents to three great enterprises—the establishment of an Institute of Science to prepare Indians for the direction of modern large-scale industries; the construction of iron and steel works as an essential link in the economic cycle; and the harnessing of the prolific rainfall of the Western Ghats to electric power stations to relieve the dependence of Bombay on far-distant coal-fields. But he died before any had reached the final stage; on the contrary, the freedom with which he spent on the development work rather seriously 'locked up' the family resources.

At this stage Dorab Tata took control of the business. With the active sympathy of his brother, the late Sir Ratan Tata, he set himself the filial task of completing his father's work. After many discouragements, thanks to the co-operation of Lord Curzon and the Government of India, the Institute of Science was established at Bangalore. Thence a steady stream of well-trained Indians has passed into the service of Indian industry. Unfortunately, Bangalore, though admirably suited climatically, is so far from the industrial centres that its activities do not command the interest and support which they should receive; but the work goes on.

The history of the Iron and Steel Works at Jamshedpur reads like a romance. The dogged tenacity with which Dorab Tata and his expert advisers searched the Central Provinces for ore surprised even his closest friends; for he was born to easy days. When their patience was rewarded by the discovery of a hill of iron ore of the finest quality at Gurumashini, the quest for capital was as baffling as that for "The Golden Girl". British enterprise does not come well out of the test. Though the existence of the requisite materials was established beyond doubt, and the home market justified the establishment of large-scale manufacture, British capital was timid and exacting, and no progress was possible. Fortunately, on the crest of the *swadeshi* wave India took this opportunity to itself and subscribed the money with an ease which surprised everyone; but equipment and operation were American and German when the British industrialist and financier missed their opportunity.

The same wave of constructive enthusiasm launched the hydro-electric works with Indian capital. Though the three associated companies—the Tata Hydro-Electric, the Andhra Valley, and the Tata Power—are capable of delivering electrical energy in Bombay far beyond the capacity for absorption, the heavy capital cost, especially during construction, has not given industry the cheap power which it demanded.

Here Dorab Tata himself would have been glad to call a halt. He was a rather reluctant partner in the manifold activities into which his house launched, and which brought anxious days when the post-War reaction set in. But he rose to the occasion and placed his private fortune behind the Iron and Steel Company when the dark days came, and, backed by the indomitable courage of his cousin, the late Mr. R. D. Tata, weathered the storm.

The qualities which Dorab Tata brought to this work were those of tenacity rather than of originating power, and a fine financial integrity. He was always willing to pay for brains, even extravagantly if he got the best. His monument is the Institute of Science, with its encouragement of pure industrial research, and the iron and steel industry, with linked enterprises, which has created a hive of industry in the virgin forests of Chota Nagpur. The contribution of his house to the renaissance of India is the recognition of the indispensability of science to modern industry, and the patriotic vision which looked beyond 'penny-in-the-slot' enterprise to the foundation of key industries, which though expensive are essential to the economic cycle.

STANLEY REED.

### DR. B. A. BEHREND

DR. BERNARD ARTHUR BEHREND died on March 25 this year, in Wellesley Hills, Mass., at fifty-six years of age; and a correspondent who knew him intimately has sent us the following appreciation of his life and work, to supplement the many memoirs which have appeared in our engineering contemporaries.

Behrend was a man of the widest interests, and

made his mark and his influence felt wherever those interests drew him. As an electrical engineer his far-sighted and vigorous pioneer work made him known as in the first rank in Europe and America. His early recognition of the genius of C. E. L. Brown (Brown, Boveri and Co.), as indicated, for example, in his series of articles in 1901–2 on "The Debt of Electrical Engineering to C. E. L. Brown", illustrated his intuitive engineering faculty for seizing and advancing upon the best features of current practice, when not actually initiating them. He had been very appreciative of encouragement in his early career from such men as Gisbert Kapp and André Blondel, and this made him ever watchful to encourage and give such praise as might fairly be given to his young assistants; indeed, many of them were of his own age or older, since he had achieved much, and had established himself, while yet quite a young man.

Behrend's literary and philosophical leanings resulted in his home being built around his library, whether in Cincinnati, Milwaukee, Pittsburgh, or Boston; while a strong antiquarian bent for early colonial furniture turned him into a collector of note. He had a wide knowledge of general scientific writings, and perhaps no man held a higher place in his esteem than Thomas Henry Huxley; he made a pilgrimage to Mrs. Huxley at 'Hodeslea' in 1910. Charles Darwin, Andrew D. White, John Perry, were intimate book acquaintances. But it was not merely such men, their fame already established, whom he held in honour, for he often showed himself an alert and aggressive champion of interests which would otherwise have continued in undeserved neglect, as witness his well-known successful activities on behalf of Oliver Heaviside.

Behrend was the recipient of many honours, and a year before his death the honorary degree of doctor of engineering was conferred upon him by Darmstadt. As an American citizen he was loyal and patriotic, but believed that the time was past for intense nationalistic feeling in men of affairs. Of comparatively small stature and frail health but intense vitality, Behrend was an antagonist indeed to be reckoned with when his indignation was stirred, but was a man of large generosity, both in sentiment and practically, to a host of men who long will gratefully remember him.

As publicity has been given to the fact that Dr. Behrend took his own life, it should be recorded here that he was convinced that he was suffering from an incurable cancer. His last years were enriched by his marriage in 1926 to Margaret Plumer Chase, of whose devotion during the long illness preceding his death he wrote in eloquent terms.

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WE regret to announce the following deaths:

Prof. Bernhard Bang, formerly veterinary adviser to the Government of Denmark and professor of internal diseases at the Royal Veterinary College, Copenhagen, known for his work on tuberculosis, on June 22, aged eighty-four years.

M. Albert Durand de Grossouvre, *correspondant* for the Section of Mineralogy of the Academy of Sciences, Paris, aged eighty-two years.

Prof. Aimé Sneider, formerly professor of zoology in the University of Poitiers, known for his work on the parasitic Protozoa, on March 27, aged eighty-seven years.

Prof. J. W. Young, professor of mathematics in Dartmouth College, Hanover, New Hampshire, author of numerous works on the fundamental concepts of algebra and geometry, on Feb. 17, aged fifty-two years.

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## News and Views

### Early Man in Java

ON p. 20 of this issue of NATURE there appears a letter on the recently found Ngandong skull, from Prof. E. Dubois, whose discovery of *Pithecanthropus erectus* and close association with palæontological research in Java entitle him to speak with authority on the question of early man in south-east Asia. After careful study of Dr. Oppenoorth's paper, he has arrived at the conclusion that Ngandong man and Wadjak man are one identical type. This view carries with it certain implications, to which Prof. Dubois briefly refers, of no little importance in the study of the evolution of human types. Wadjak man is represented by two skulls discovered in the terraces of a dried-up fresh-water lake near the southern coast of Java, one in 1889 and the second by Prof. Dubois himself in the following year, and brought back by him from Java in 1895, but not described until 1921. These skulls have been regarded as ancestral to the Australian; but it has been pointed out, notably by Sir Arthur Keith, that Wadjak man, so far as described, presents certain points of resemblance to Rhodesian man—for example, in the relatively enormous size of the palates, of which the area is identical. Prof. Dubois regards one of the Wadjak skulls, which in this respect differ *inter se*, as approaching the Ngandong skull in the shape of the occiput and other points; while Oppenoorth says of the latter that it resembles the Rhodesian skull, especially in the shape of the occipital bone, while the back of the skull "bears a resemblance to the Australian race". Thus with the Talgai skull of Queensland—probably pleistocene, and probably a relative of the Wadjak man, but still more closely related to the modern Australian—the newly discovered Javan skull apparently helps to link up a group of skulls, reaching out experimentally, if not in a direct line of ascent, to the modern Australian type.

### Magic and Medicine Men

ALTHOUGH there is a great similarity in the supernormal performances of witches and medicine men wherever recorded, the selection of certain alleged powers of West African magicians as the subject of a challenge by the local Council of the Christian Missions (see NATURE, June 11, p. 862) adds interest to the

practices of certain members of the Bear gens of the Fox Indians of Oklahoma, to which reference is made in a recent publication of the Bureau of American Ethnology ("Notes on the Fox Wâpanowiweni": by Truman Michelson, *Bull.* 105). The bear, it may be mentioned, in parenthesis, is considered among the Fox to be the most dread form of witch. An Indian informant, who, significantly enough, wished to remain anonymous, stated that he himself had seen certain members of the gens remove stones or feathers from a box without touching it or its contents. Balls of fire were produced, and skins of snakes and cat and otter skins came alive and spoke. In the matter of the closed box the identity with the West African claim is noteworthy. Other performances resembled those of the spiritualistic medium. Stones ran round in a circle. The witches successfully called on the Wâpanowi birds (spirits) to come; they handled red-hot coals without suffering harm, and plunging their bare arms into boiling water, took out meat with impunity. This last feat has been recorded among a number of the American Indian peoples.

AN attempt by Fox Indian witches to injure or kill an individual who sought to ward off their attempts on his sister, was frustrated by giving them a feast at which the food provided by their host and intended victim was the head of a witch who had been captured by burning cedar leaves. When the witches invited him to a ceremonial feast, they were unable to take the meat from boiling water with bare arms, but he succeeded; they handled red-hot coals and he did the same. Then they became afraid. The next day the ceremony ended without any special event. Presumably the intended victims had evaded the danger. It will be remembered that it was claimed for the notorious medium Home that he had transferred his immunity to red-hot coal to someone else for a brief period; but with the Fox the transfer would seem to have been involuntary, although, it is said, the intended victim had been told previously "how to excel in shamanistic tricks". It has been questioned whether medicine men and shamans have the hypnotic powers sometimes claimed for them—rather, it is to be feared, as the last resource of an exhausted attempt at explanation; but it may be noted that it is said of one Fox witch that "when he was looked at steadily by anyone, the other became sleepy, . . . and . . . when [anyone] did not take his gaze from him, he fell asleep".

### Anniversary of the Science Museum

THE South Kensington Museum was first opened to the public on July 1, 1857, and the seventy-fifth anniversary is being marked at the Science Museum by a special exhibition of technical apparatus, etc., which will remain on view until October. The wonderful progress which has been made in all branches of science and technology is shown by exhibiting examples which were in use during the decade 1850–60 alongside the corresponding types which are in use to-day, and emphasising the contrast in the descriptive notices. Air, land, and water transport are represented, and the remarkable advances which have been made in mathematical instruments, lighting equipment, telegraphy, typewriters, sewing machines, marine engines, pumping machinery, stationary engines, metallurgy, and other fields are shown by actual examples or by scale models. The discovery of the first artificial dye by W. H. Perkin in 1856 provides a very striking example of the progress made in industrial chemistry when the products of that date are compared with those of the dyeing industry of to-day. Besides a type exhibit placed among the others of the exhibition, a much larger and more representative display of modern dyes and dyed materials has been arranged in Gallery 66 on the top floor of the Museum. A series of plans shows how the Gore Estate has been developed by the Commissioners of the Great Exhibition of 1851 during the past eighty years, from the original group of green fields to the great intellectual centre which it is to-day. Since the South Kensington Museum, now represented by the Victoria and Albert Museum and the Science Museum, was established on the initiative of the Prince Consort, the attendance records total more than seventy-eight million, and about two million visits annually are still recorded.

### National Prosperity and Control of Production

IN a pamphlet entitled "The Next Step", Capt. Harold Macmillan, M.P., advances the proposition that prosperity is conditioned by equilibrium in production. If the forces of production are properly distributed in the production of consumptive goods, and if the rate of saving is equalled by the rate of capital investment, then the total products will exchange against each other and prices and employment will be stable. This is the ideal production balance, but the difficulty of maintaining it becomes evident when it is visualised as a continuous rather than a static balance. Fluctuations are inevitable, and the balance may be upset by financial, political, or industrial forces. Capt. Macmillan therefore argues that it is necessary to create an organisational structure which will guide the flow of capital investment, secure the production of commodities in the quantities which scientific market study directs, and maintain stability of prices as the governing principle in credit policy. To attain these ends, he advocates the following programme: (1) a scientific system of selective protection of our home market; (2) the establishment of representative national councils for each industry, to co-ordinate purchasing, production, marketing, and research; (3) the creation of an investment and development board representing the Government, industry, and finance, to direct investment into the correct channels, to influence credit policy, and to direct the efforts of the councils of industry so as to achieve a new internal production balance in relation to the most scientific estimation of market requirements; (4) reflation to the 1928 price level.

CAPT. HAROLD MACMILLAN also advocates the "planning of stability". He argues that Britain has inherited a population and economic structure adjusted to a stage of world development which is past. Adjustments must now be made which ought to have

been taking place in response to these changes as they occurred, while in the future continuous adaptation will be required. Britain has now entered a period in which planning—conscious direction and intelligent anticipation—is essential to national welfare. Industry is already striving towards that integration and unity which modern conditions demand, and these efforts must be assisted. A sufficient measure of centralisation of control is required to enable the activities of separate industries to be brought into harmony with the economic objectives essential to national welfare and prosperity as a whole. The units of productive effort need to be controlled by a co-ordinating central authority sufficiently representative and sufficiently powerful to direct capital and labour into the correct channels to maintain equilibrium. Even already, Britain has been moving into this field of conscious endeavour by the road of protection, agricultural marketing, the regulation of wheat and coal production, the centralised direction of electrical power distribution, and now by the subordination of credit to the needs of industry. Mistakes have, of course, been made in the past, but improvements will have to be carried out as experience is gained.

### New Index Number of Profits

IN his valedictory address on June 21 as president of the Royal Statistical Society, Sir Josiah Stamp described a new index number of profits, which he has constructed. This consists of a general index of profits designed to show changes in the return to capital as a whole and a special sub-index showing variations in the return for risk-bearing capital (ordinary shares, etc.). Both indices are comparable with the index of production, the various price indices, and other statistics. For technical reasons, the year 1924 has been selected as the base period, but the numbers have been carried back to 1920 as shown in the following table:

| Year. | General Index. | Special Index. |
|---|---|---|
| 1920 | 107·0 | 112·0 |
| 1921 | 68·7 | 57·3 |
| 1922 | 90·4 | 84·6 |
| 1923 | 94·1 | 90·6 |
| 1924 | 100·0 | 100·0 |
| 1925 | 104·1 | 109·3 |
| 1926 | 98·3 | 103·0 |
| 1927 | 106·5 | 111·4 |
| 1928 | 106·2 | 110·7 |
| 1929 | 109·9 * | 114·3 |
| 1930 | 100·9 † | 94·4 |
| 1931 | 92·0 † | 80·9 * |

* Provisional, subject to early verification.
† Very provisional.

Sir Josiah Stamp pointed out that his index referred to changes in the *aggregate amount* of profits, and not to the *rate of return* on capital. Inasmuch as a large increase has taken place in invested capital since 1924, the fall in the rate of return per unit of capital is greater than that of any fall indicated by the aggregate index. The index shows that the range of boom and depression is far smaller in Great Britain than in the United States.

### The Patents and Designs Bill

CONFIDENCE which was placed in the Joint Chemical Patents Committee on its formation has been fully justified by the record of its activity. This committee of the Association of British Chemical Manufacturers, on which the Chemical Society, the Institute of Chemistry, and the Institution of Chemical Engineers are represented, gave evidence before the Board of Trade Departmental Committee on the Patents and Designs Acts and the practice of the Patent Office, during the inquiry which extended over eighteen months. The Patents and Designs Bill recently introduced into Parliament proposes to give effect to the recommendations of this Departmental Committee, generally known as the Sargant Committee; on publication, the Bill was examined by the Joint Chemical Patents Committee, and was considered still to contain a number of points of importance requiring amendment. As a result of the presentation of a memorandum to the Board of Trade, followed by a deputation, almost all the desired amendments have been secured at the committee stage of the Bill. For example, more effective provision for dealing with the abuse of user patents, whereby the manufacture of non-patented substances was being restricted or entirely prevented in Great Britain, has been obtained. The section dealing with the remedy in case of groundless threats of legal proceedings has been amended, and the appeal tribunal is to have power to obtain the technical assistance of an assessor in all cases. So far as the costs of appeal are concerned, the present atmosphere of appeals to the law officer is to be preserved, although in certain respects the tribunal will be regarded as a court of the High Court. It is a valid claim that these major amendments will both strengthen the new Act and afford great assistance to the poor inventor.

### Prof. H. Brereton Baker

ON the occasion of his seventieth birthday, Prof. H. Brereton Baker and Mrs. Baker were, on June 25, entertained at dinner at the Imperial College of Science and Technology by a number of colleagues and former pupils. The rector of the Imperial College, Mr. H. T. Tizard, presided, and the company included distinguished representatives of those who had been associated with Prof. Baker's work at Dulwich College, at the University of Oxford, and at the Imperial College, London. *Ave* was, however, accompanied by *Vale*, for at the end of the present academic year Prof. Baker retires from the directorship of the Chemistry Department of the Imperial College and from his chair of chemistry in the University of London; fortunately, however, Prof. Baker will continue actively to prosecute his researches, and will occupy accommodation which has been placed at his disposal for that purpose by the College. Tribute was paid to Prof. Baker's work, both for chemical science and for the institutions with which he has been associated, by Mr. Tizard, Mr. R. T. Lattey, Mr. D. L. Chapman, and Prof. H. E. Armstrong. During the evening an inscribed album was presented to Prof. Baker, and Mrs. Baker was asked to accept a piece

of jewellery; decision regarding the nature of the principal gift awaits the intimation of Prof. Baker's wishes. It is known, however, that Prof. Baker, whose interest in the establishment of the College hostel has resulted in so marked a development in the students' social life, is anxious to commemorate his association with the Imperial College by placing a clock in the quadrangle, and intends to devote the major part of the presentation fund to that purpose.

### New Buildings at Rothamsted

THE annual inspection of the experimental plots and laboratories at Rothamsted on June 21 was made the occasion of the official opening of a new block of buildings at the farm and the inauguration of an extensive electrical installation in the farm buildings. The Right Hon. Sir John Gilmour, Minister of Agriculture, declared the buildings open, in the presence of a large gathering of guests representing all branches of agriculture and the allied industries, and many of the visitors came from distant parts of the Empire. The new block of buildings will serve both the field experimental and demonstration sides of the farm. It contains an artificial manure store, working and office accommodation for the field experimental staff, and equipment to deal with the drying and preparation of the numerous samples taken in the course of the modern experiments. The purpose of the demonstration room is to facilitate the presentation of the field results which have direct practical interest in a way which is easily grasped by visitors. Diagrams and models take the place of tables of figures. Good types of machinery are illustrated, successful rations fed on the farm are on record, and exhibits of plant disease are set up as they become available. The electrical installation, designed by the General Electric Company, Ltd., will be of the most modern and complete kind, and will provide very valuable information as to the cost and general efficiency of motor-driven farm machinery in comparison with the older oil-driven type. The many visitors to Rothamsted are always interested in the excellent collection of modern implements loaned or presented by the makers. The installation of electrical equipment will greatly add to the demonstration value of this side of the farm.

### Southern Railway Electrification

APPRECIABLE progress is being made on the Southern Railway's London-Brighton electrification scheme. According to the *Electrician* of June 24, 'streamlined' electric trains have been undergoing night time tests. The first half of the new scheme—the extension to Three Bridges—will be opened on July 17. Thirty-three new trains will be employed, fitted with high speed motors and stream-lined, so that speeds of 70 miles an hour will be possible. The third class compartments have been built like the old first class compartments, and extra width has been given to the seats. The coaches have been built to the maximum width limit of the track, so it is impossible to use the 'bay window' type of look-out for the guard. The guards will see the signals through a periscope which projects through the roof. The signalling system has been changed throughout the route from the semaphore to the colour-light type. Whenever a train passes, the signals are automatically put to danger. An ingenious device is fitted in every signal-box which enables the signalman to know the exact nature of the trains that are approaching and their times. From July 17 there will be 61 trains running daily from London to Three Bridges, compared with 27 at present, while Three Bridges will have 57 trains to London in place of 19. The fastest trains have been timed to do the 30 miles in 39 minutes, but the average time for all the trains has been reduced from 60 to 52 minutes. The second stage of the scheme will probably be completed by March next.

### Gyro-stabilisers for Liners

ALTHOUGH the theory of the gyroscope has been taught for more than fifty years in several universities, it is only recently that the instalment of gyro-stabilisers for ships, yachts, and aircraft carriers has begun to be adopted. The largest gyro-stabilising plant in the world has recently been completed for the new 46,000-ton luxury Italian liner *Conte-di-Savoia* at the works of Messrs. Vickers, Armstrong, Ltd., Barrow-in-Furness. An interesting account of the plant is given in the *Metropolitan-Vickers Gazette* for April. The plant consists of three identical stabiliser equipments, each one of which can function as a stabiliser independently of the other two. The rotating element in each consists of two solid forged steel disks. The rotating part (the rotor) weighs 110 tons and at normal working speeds it rotates at 910 revolutions per minute, being driven by a spinning electric motor mounted directly on the shaft. This motor is of the three-phase type and gives 560 horse-power at the normal speed. It is capable of giving 750 horse-power for 90 minutes during the accelerating period. The Sperry gyro-stabiliser is used, and this never allows the vessel to start rolling. A single wave can start a roll. In an unstabilised vessel, should the period of the rolling swings and the waves be the same, resonance might occur, and if the damping were small the rolling might become dangerous. Usually, however, the waves are only synchronous with the ship's natural swing for a brief period, and so its maximum swing is due to the accumulated effects of the waves. The Sperry device quenches the effects of these waves one by one, and so the stresses and strains on the hull of a stabilised ship are comparatively slight.

### Human Improvability

DR. C. S. MYERS contributes an article on "Human Improvability" to a recent issue of the *Bristol Medico-Chirurgical Journal* (vol. 49, No. 183). He says that the problem of human improvability is as interesting as it is difficult. One difficulty lies in the definition of *improvement*, which is not necessarily synonymous with *progress*, and for which we can have only subjective criteria. The prevailing biological view is that all changes in living form and function are evoked by accident, and are perpetuated by heredity and by their suitability to the environment; improvement might then be regarded as involving a more perfect adaptation to the physical and social environment.

Some thinkers, however, find such a view inadequate to account for the facts, and therefore postulate in addition some, to us unknown, purpose in the universe. Our developing knowledge of other peoples has replaced many illusions as to natural differences by the recognition of likenesses as well, and confirms the importance of the social environment. It is not unlikely that man's mental and moral development depends in part upon the relation between his inheritance and the physical and social environment in which he grows up. Dr. Myers analyses several modern environmental conditions and concludes that changes have occurred which justify a belief in human improvability; these improvements do not, however, appear to come from the innate improvability of a race but from the improvement in the social heritage. The paper is provocative and stimulating, and in view of Dr. Myers's intimate knowledge of many aspects of modern civilisation, it is worthy of very serious consideration. It is all the more important at the present time, when so much pessimism is shown in the interpretation of the changes which our environment is experiencing.

### British Poisonous and Edible Plants

EXCEPTING works on poisonous plants from the agricultural and medical points of view, there is very little printed information available to the lay reader. Fortunately, most British poisonous plants are rare; but the most dangerous are those with an attractive and luscious appearance. Perhaps that is why, despite their scarcity, such plants are the cause of illness and even death to unwary ramblers, campers, and school children every year. The pamphlet recently published as a reprint from *School Nature Study* therefore comes as a timely warning, not only to the country child and the town child in the country, for whom it is written, but also to adults who take an active part in country life. The pamphlet, "British Poisonous and Edible Plants", written by Miss Hilda F. Rendle, after a few introductory remarks, gives a list of edible plants found growing wild. These are divided into black fruits, scarlet fruits, seeds and nuts, flowers, leaves, roots, and fungi. The second part deals with the poisonous plants, giving not only the well-known plants such as laurel, bryony, deadly nightshade, etc., but also some of the less familiar types such as the spindle with its attractive pink fruit and orange seeds, potato 'apples', and acorns. A few of these are illustrated. It is a pity that the fungi were not given more space. Only the common mushroom (*Psallista*) is described, with the concluding remark that "all other fungi should be avoided". In the present day of extended country activities, this pamphlet should be welcomed by all school teachers, boy scouts troops, country rambling organisations, etc. Copies at 2½*d*. each or two shillings per dozen can be obtained from Mr. E. G. Clarke, 7 Stanley Avenue, Wembley, Middlesex.

### Acquisitions at the Natural History Museum

THE Department of Botany, British Museum, has received 320 plants collected by Mr. H. St. J. B. Philby, on his recent Arabian journey and presented by the King of Hejaz and Najd. The plants are of interest botanically as being from an area previously unexplored. It has to be remembered that, from an economic point of view, plants are of the greatest importance in deserts, and according to Mr. Philby the Arabs know them so well as camel food or otherwise that they are able to judge the date of the last rains from their presence or absence. The Arab name is attached to each plant. Acquisitions of the Department of Minerals include meteorites collected by Mr. Philby, a piece from the 15-ton mass of meteoric iron discovered in 1930 near Mbosi in Tanganyika Territory, a piece of a meteoric stone which fell recently near Kirkuk, Iraq, and a specimen of pitchblende from the recently discovered occurrence on the Great Bear Lake, North-West Territory, Canada. Dr. Robert Broom has presented to the Geological Department a small series of South African fossil reptiles, several of which are the types of genera and species recently established by the donor. They belong principally to Therocephalian and Dicynodont genera, and range from Permian to Trias in age. Through the generosity of Rear-Admiral H. Lynes, Mr. Jack Vincent has been collecting for the Museum in Portuguese East Africa, the birds of which are very little known; already two consignments have been received. A collection of more than a thousand birds from Yunnan obtained by the late Mr. G. Forrest, the well-known plant collector, has been presented by the Godman Exploration Fund, while Dr. P. A. Buxton has presented a collection of some 750 birds made by him during the War in Iraq and Persia.

### Publications of the Institut Henri Poincaré

THE completed first volume of the *Annales de l'Institut Henri Poincaré* (Paris: Institut Henri Poincaré; Les Presses Universitaires de France) contains a highly interesting set of papers on theoretical physics and its mathematical borderland, of varying degrees of difficulty, several of which have been referred to in our columns on their appearance. The contributions verging on the purely mathematical include two on integral equations, by Kostitzin and Carleman, one by Brillouin, on a hyperbolic equation, and two, by Lévy and Polya, on the calculus of probabilities. Relativity is represented by Einstein and de Donder, and quantum theory by Darwin, Fermi, Born, and Dirac. The other papers are by Brillouin, on fusion, and by L. Bloch, on band spectra. It will be evident that the list of authors is one of unusual authority, a feature continued in the first numbers of the second volume by the inclusion of Sommerfeld and Cabrera. Their respective papers also give in short the aim of all, which appears to be to comment on current problems, or to collect and criticise otherwise scattered work. The papers are based on lectures delivered under the auspices of the Institut Henri Poincaré, and the only important change to be desired is that less time should be allowed to elapse between the delivery of the lecture and the time when it appears in print.

### Population of England and Wales

THE "Text" (final) volume of the Registrar-General's Statistical Review, England and Wales, 1930, has been published (H.M. Stationery Office, 2*s*. 6*d*.

net). It contains the official commentary on the vital statistics contained in Parts i. and ii., Medical and Civil Tables, already issued. The population at the middle of the year was estimated at 39,806,000 persons, made up of 19,075,000 males and 20,731,000 females, the excess of females being most marked in the age groups between thirty and fifty-five years. The death-rate, 11·4 per 1000 population, is the lowest on record. The deaths ascribed to cancer (57,883) are the highest yet recorded, but when standardised are almost the same as, and no higher than, the preceding year. Attention is directed to the increasing mortality associated with motor-vehicles, and particularly with motor-cycles. During the six years 1925–30, motor-cycles were associated with the deaths of 2752 young men between the ages of fifteen and thirty-five years, which is 2·8 times the number killed in the preceding 14 years. The corresponding numbers of young women were 316 and 79, a fourfold increase.

### Grant in Aid of African Research

A FURTHER grant in aid of research in Africa by the trustees of the Rockefeller Foundation is announced. The sum of £3000 per annum for a period of three years has been granted to the School of Oriental Studies in the University of London for the furtherance of research in African linguistics. This subject is already included in the curriculum of the school as part of the work of the Department of Phonetics and Linguistics, acting in co-operation with the International Institute of African Languages and Cultures. Now that the Oriental Institute has this additional fund at its disposal, it will be possible to extend its activities in this subject especially in the field of original research. It will be remembered that the Rockefeller Foundation is already assisting liberally African research in Great Britain by the grant of £5000 a year, to be increased in certain contingencies to £10,000, to the International Institute of African Linguistics and Cultures ; and this grant is being used to meet the cost of a scheme of research which has been planned to cover a period of five years.

### Announcements

SIR WILLIAM BRAGG, director of the Royal Institution, left England on June 25 for a lecture tour in South America under the auspices of the Ibero-American Institute of Great Britain, of which H.H. the Prince of Wales is president. On the previous day Sir William was received by His Highness, who expressed his interest in the tour. Sir William is due at Buenos Ayres on July 15 and leaves there on Aug. 1, when he goes on to Rio de Janeiro, arriving there on Aug. 6 and staying until Aug. 14. At both places he will be the guest of the British Ambassador and will deliver lectures on recent work on X-rays and crystal analysis. Sir William is expected back in England about Aug. 29.

As noted briefly in our issue of June 11, p. 860, the centenary of the birth of Sir William Crookes fell on June 17. In 1859 he founded the *Chemical News*, and the issue of that journal for June 17 is very appropriately dedicated to his memory. Lord Rutherford contributes a descriptive article on the artificial transmutation of elements, Sir Harry McGowan has a short article on Crookes's well-known forecast of a world wheat shortage in relation to chemical industry, and other articles deal with various aspects of Crookes's life and scientific work. The issue includes full-page reproductions of photographs of Crookes and Lord Rutherford.

THE Medical Research Council announces that, on behalf of the Rockefeller Foundation, it has made the following awards of travelling fellowships for the academic year 1932–33 ; these fellowships are awarded to graduates who have had some training in research work either in the primary sciences of medicine or in clinical medicine or surgery, and who are likely to profit by a period of work at a chosen centre in America or, in special cases, in Europe, before taking up positions for higher teaching or research in the British Isles :—Mr. C. P. Beattie, Bacteriology Department, University of Edinburgh ; Mr. W. D. W. Brooks, St. Mary's Hospital, London ; Dr. Eleanor M. Creak, Maudsley Hospital, London ; Mr. I. G. W. Hill, Royal Infirmary, Edinburgh ; Mr. W. A. Mackey, Department of Surgery, University of Glasgow ; Mr. D. J. Macmyn, King's College Hospital, London ; Dr. J. C. Moir, University College Hospital, London. In view of the high qualifications of so many of the candidates, the Council greatly regrets that it has not been possible to make a larger number of awards.

MESSRS. H. K. Lewis and Co., Ltd., 136 Gower Street, W.C.1, have just issued a very useful classified catalogue of books, in new condition, on physics and mathematics. An admirable feature is the insertion of the year of publication of each volume.

UPWARDS of 2000 works dealing with ornithology are offered for sale, at what appear to be reasonable prices, by Messrs. Wheldon and Wesley, Ltd., 2 Arthur Street, W.C.2, in catalogue New Series, No. 28. The catalogue is obtainable free upon application.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned :—A full-time lecturer in the Department of Building of the Leeds Technical College — The Director of Education, Education Department, Calverley Street, Leeds (July 6). A teacher of metalwork and technical drawing, and an assistant master to teach principally chemistry and mathematics, in the Junior Technical School of the Castleford, Normanton, and District Mining and Technical Institute, Whitwood—M. G. Swaine, Education Offices, Castleford (July 8). An assistant lecturer in mathematics in the University of Birmingham—The Secretary, The University, Birmingham (July 15). A lecturer in pharmacology in the Department of Physiology of the University of Bristol—The Secretary and Registrar, The University, Bristol (July 22). A secretary of the Jamaica Agricultural Society—The Secretary, Jamaica Agricultural Society, 11 North Parade, Kingston, Jamaica, B.W.I. (Sept. 5).

## Letters to the Editor

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, nor to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

### Early Man in Java

THE paragraph on early man in Java, in NATURE of June 11 (p. 863), concerning the Ngandong skull, induces me to make the following remarks.

Mr. W. F. F. Oppenoorth, who described the skull, says in the Summary, p. 63 of his paper : [1]

"Just in those features, where the Ngandong skull deviates from the Neanderthal type—especially in the shape of the occipital bone—it approaches a skull, found some ten years ago in South Africa, now known in literature as the Rhodesian skull ; the torus supra-orbitalis, however, of the Ngandong skull is not so heavy and a little more bent.

"The back of the Ngandong skull also bears resemblance to that of the Australian race, so perhaps we may see in it a much more primitive prototype of that race than was the Wadjak man of Dubois.

"I think it justifiable to separate the Ngandong skull and call it *Homo* (*Javanthropus*) *soloensis*, n. subg., n. sp."

I may here direct attention to the well-known fact that in the slope of the nuchal plane of the occipital bone, there is a wide range of variation in Australian skulls, and there is also great individual difference, in this respect (among other things), between the two skulls of Wadjak man,[2] from one of which only I described the strikingly primitive upper and lower jaw, the brain case and the other bones of the face being in a fragmentary and incomplete condition. This skull much more approaches the Ngandong skull, in the shape of the occiput and in other respects.

A careful study of Oppenoorth's paper, which is called a 'preliminary' report, leaves little doubt, however, in my mind, that Ngandong man and Wadjak man are one identical type. The new skull, in my opinion, bears out the proto-Australian character of the Wadjak type, and also tends, I believe, to designate Rhodesian man as the prototype of the species *Homo sapiens*.

EUG. DUBOIS.

Haarlem,
June 11.

[1] *Homo* (*Javanthropus*) *soloensis*, een Pleistocene Mensch van Java (Voorloopiye mededeeling). Wetenschappelijke Mededeelingen No. 20 van den Dienst van den Mijnbouw in Ned.-Indië, pp. 49-63, six plates. Batavia, Landsdrukkerij, 1932.

[2] Described in *Proc. Kon. Akad. Wetenschappen*, Amsterdam, vol. 23, pp. 1013-1051, two plates ; 1921.

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### The Inheritance of Acquired Characters

PROF. MACBRIDE'S criticism [1] of my lecture on the inheritance of acquired characters falls into three parts. He claims that I have misinterpreted Lamarck, that certain experiments demonstrate the transmission to the offspring of characters acquired as the result of a change of environment, and finally that this latter principle can be inferred from other facts, apart from the results of any experiment.

Lamarck, as I pointed out, used different language on different occasions. I think that my second citation from him shows that, sometimes at least, he expressed the views which I attributed to him.

I am glad that Prof. MacBride does not deny that Dürken employed selection. But, he writes, "selection as an effective cause of anything is a superstition that dies hard". Selection is quite an effective cause of change of the proportions in which various types occur in a mixed population. And such a change was all that Dürken obtained. Some of his original population gave green pupæ. He selected these, and got a larger proportion in later generations. The facts cited by Prof. MacBride in his letter as to the behaviour of certain larvæ in orange light are irrelevant to the issue, namely, whether this treatment, apart from selection, increases the proportion of green pupæ *in a given environment*, in successive generations.

I must apologise, in this connexion, for writing *Pieris rapœ* for *P. napi*. I must also apologise to readers of NATURE for quoting Prof. MacBride's account of Metalnikoff's experiment rather than the original. I have read three accounts by Metalnikoff of his experiments, and from none of them can I discover whether he bred from those caterpillars which had been immunised both with living and dead bacteria, as appeared from Prof. MacBride's lecture, or only from the latter class, as he states in his letter. The interpretation of his results depends on which alternative was true.

Prof. MacBride dismisses a hypothesis which he attributes to me as "fantastic", on the ground that *Salix rubra* is a rare hybrid. Actually it is of such economic importance that three different strains of it are grown for basket-making, and common enough to occur in sixty-nine of Druce's British vice-counties. On the other hand, the original host species *S. andersoniana* is an economically unimportant plant occurring in only thirty-four vice-counties. The hypothesis that some of the ancestors of flies colonising the latter had lived on the former does not appear particularly fantastic. Of the "larval memory hypothesis" we read that "it assumes that the instinct of the mother to seek a certain plant and the capacity of the larva to live on this plant are inseparable". After discussing the larval memory hypothesis I actually wrote, "The *other* factor in successful colonisation is the ability of the larva to eat and digest its food". The assumption (which is clearly false) was therefore Prof. MacBride's and not mine.

Against the eminent authorities cited in favour of Lamarckism, I will only quote one, namely, the Royal Society's motto, "Nullius in verba". I am awaiting such experimental confirmation of their views as would be furnished by a successful repetition of McDougall's experiment.

To call the alternative theory that of "Chaos and Chance" does not, of course, disprove it. The kinetic theory of gases proves that chaos and chance can form the basis of very exact and fully verifiable predictions. Unfortunately for the kinetic theory of species, conditions in a natural population are not chaotic. Mutation does not occur in all directions. From a knowledge of the types of mutation common in one species we can predict those common in another. And mating is not in general at random. If a species were a real chaos, the theory of evolution would be nearly as simple as the kinetic theory. So I fear that Prof. MacBride's phrase may have led readers who are acquainted with that theory to suppose that the case for neo-Darwinism is even stronger than is actually the case.

J. B. S. HALDANE.

Roebuck House,
Ferry Lane,
Cambridge.

[1] NATURE, **129**, 900, June 18, 1932.

### Developments in the Chemistry of the Anthocyanins

IT is a remarkable fact that almost the whole range of anthocyanin pigments of flowers, fruits, and blossoms is derived from the three fundamental anthocyanidins, namely, pelargonidin, cyanidin, and delphinidin, by various substitutions in the hydroxyl group. A very extensive survey of the colouring matters of this class conducted during the last two seasons has only served to emphasise the prevalence of the three known types.

Nevertheless, the existence of exceptions has already been recognised by Willstätter, who found that the bluest anthocyanins occurring in the beet, in *Celosia cristata*, and in *Atriplex hortensis* are nitrogenous pigments. At the other end of the scale, the most yellow anthocyanin was noted in *Papaver alpinum*, and a similar substance which colours the yellow Iceland poppy is in progress of investigation in this Laboratory by Miss R. Scott-Moncrieff. Quite a different anthocyanin has now been found to occur in the orange-red flowers of *Gesnera fulgens* (or *G. cardinalis*). This anthocyanin we propose to term *gesnerin*, and it is a 5-saccharide (unidentified sugar residue) of 4′ : 5 : 7-trihydroxyflavylium chloride. On hydrolysis it yields the anthocyanidin chloride which was readily identified as apigeninidin chloride,[1] the synthesis of which was effected in 1925 because it was thought probable that a derivative of the substance would occur in Nature. The major anthocyanidins are related to naturally occurring flavonols and it was thought probable that similar substances derived from the flavones in a similar way might be encountered ; this expectation has now been realised in the case of the anthocyanidin related to the flavone apigenin. A further search among the Gesneriaceæ and other families of the Personales will be made, since it seems very probable that the anthocyanin derived from luteolinidin will also be encountered.

The suggestion first made in these columns, that some of the more important anthocyanins are 3 : 5-diglucosides, has been amply confirmed by synthesis.

Dr. A. R. Todd in collaboration with one of us has already succeeded in synthesising hirsutin, malvin, and cyanin chlorides, and synthetical indications have been obtained in regard to peonin and pelargonin chlorides ; all these pigments bear two glucose residues separately attached to oxygen atoms in positions 3 and 5 of the anthocyanidin molecule. An independent confirmation of the correctness of these views is obtained from the work of Prof. Karrer and his colleagues, who have been able to show that the process of oxidation of many anthocyanins by hydrogen peroxide, followed by hydrolysis, results in the detachment of only one hexose unit, obviously that attached to position 3 (private communication). The hypothesis that anthocyanins of the mecocyanin type are 3-biosides has also been confirmed by synthesis of representatives of all the possibilities (for example, cyanidin 3 : 7-diglucoside, 3-cellobioside, and 5 : 7-diglucoside), and by an examination and comparison of their properties.

We were naturally much interested in the letter of Mr. W. J. C. Lawrence [2] on the subject of the co-pigments which modify the colour of dahlias, pelargoniums, etc., as we have long been of the opinion that the chief co-pigments are the tannins and anthoxanthins, including the flavone and flavonol glucosides. Until, however, these substances have been isolated and identified, speculation as to their nature seems premature. Nevertheless, experiments with pure anthocyanins and pure flavonol derivatives have proved very suggestive, and, for example, the appearance and properties of a co-pigmented violanin solution from purple violas can be simulated by means of a synthetic anthocyanin in association with quercitrin.

We have found the phenomenon of co-pigmentation almost universal in flower colours, almost all of which are bluer than they should be at the *p*H obtaining in the cell sap. The degree of the effect is, however, very varied in different flowers, and, as we have already suggested, a genetic factor for flower colour is frequently connected with the development (or, it may be, the suppression) of a co-pigment.[3]

In addition, we pointed out that the co-pigment might remain as a constant factor in certain cases, and that a change of colour tone might result from an increase in the concentration of the anthocyanin. Thus in the ordinary lilac there is a co-pigment, found also in the white flowers, which with a low concentration of anthocyanin produces the familiar pale mauve colour ; the deeper red shades are the result of an increased proportion of colouring matter, and the deep bluer red varieties contain both pigment and co-pigment in greater concentration. An alternative to the latter part of this statement is obviously that a new and more efficient co-pigment has been developed.

G. M. ROBINSON.
R. ROBINSON.

Dyson Perrins Laboratory,
University of Oxford,
June 14.

[1] Pratt and Robinson, *J.C.S.*, **127**, 128.
[2] NATURE, **129**, 834, June 4, 1932.
[3] *Biochem. J.*, **25**, 1687 ; 1931.

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### Mass-Spectra of Helium and Oxygen

IN the course of my analyses of leads of different origins I have had opportunity of making some interesting observations on these two elements. While preparing a new discharge tube by preliminary running, a mixture of helium and oxygen was used and a search was made for the line due to $He^{++}$. The occurrence of doubly charged helium atoms *in the discharge* was inferred during the early work of Sir J. J. Thomson [1] and has recently been very beautifully demonstrated by Conrad,[2] but the evidence in each of these cases was indirect, namely, the prolongation of the normal helium parabola. All attempts so far made to photograph the line of $He^{++}$ as a satellite of the line $H_2$ by means of the mass-spectrograph have been unsuccessful.

These failures I have ascribed to my use in the past of cooled charcoal (incapable of absorbing helium) for the high vacuum parts of the apparatus. This explanation appears to be correct, for by reducing the pressure in the slit system and the camera to a much lower value by a diffusion pump and lowering the intensity of the $H_2$ line by continuous washing with oxygen and helium, the doubly charged line of the latter has now been found. It is indeed still much too faint compared with $H_2$ for accurate measurement, but there is now reasonable hope that with a setting of the discharge tube more favourable to atomic lines and more careful washing it will be possible to reduce the pair to approximately equal intensity. The distance between these lines will then afford a really direct and trustworthy measure of the ratio of the masses of the helium and hydrogen nuclei, a figure of fundamental importance in nuclear physics.

During these experiments it was noted that the helium-oxygen mixture gave much stronger oxygen lines than did pure oxygen, and since the oxygen molecular line was so bright that it could be seen on the willemite screen, conditions were very favourable for the detection of the two faint isotopes of oxygen. The atomic lines 17 and 18 are unsuitable for this, owing to the presence of OH and $OH_2$, but the molecular lines 33 and 34 due to $O^{16}O^{17}$ and $O^{16}O^{18}$ respectively may be expected to be fairly free from

contamination. Furthermore, their intensities relative to the main line 32 will be double those of atomic abundance. On photographing the spectra all three lines were quite clear, and by giving suitable exposures, for example, 3 seconds and 15 minutes, their relative intensities could be estimated. Line 32 was found to be 268 times as intense as line 34, which was 4·2 times as intense as line 33.

These can only be regarded as rough minima, for owing to the action of the oxygen discharge on the wax and grease it is certain that sulphur is present, and if to the extent of 1 per cent, would enhance line 34 by about ten per cent and line 33 even more. It is clearly useless to push the accuracy further until an apparatus is available from which sulphur and other possible sources of contamination can be excluded, but so far as they are valid, the ratios 536 and 4·2 support the figures 630 and 5 given by Mecke and Childs [3] as against the lower abundances previously estimated.

F. W. ASTON.

Cavendish Laboratory,
Cambridge, June 16.

[1] "Rays of Positive Electricity", 83; 1921.
[2] *Phys. Z.*, **31**, 888; 1930.
[3] *Z. Physik*, **68**, 362; 1931.

### An Ocean Sunfish in Malaysian Waters

THE species under consideration (*Mola lanceolata*) is so rare that I venture to think that a preliminary note on a recent capture may not be out of place in the columns of NATURE. A more detailed account will, it is hoped, appear in the *Bulletin of the Raffles Museum* during the course of the year.

A specimen of an ocean sunfish, *Mola lanceolata* (Liénard), was taken in a fishing-stake at Noembing, off Bintan Island in the Rhio Archipelago, during the night of April 11–12, 1932. Fortunately, the owner of the stake realised the unusual nature of his catch and presented it to this Museum.

The adult specimens now known appear to be as follows:

1. The type, described by Liénard in 1840, taken off Mauritius.

2. A specimen taken off Amboina and described by Bleeker in 1873 as *Orthagoriscus oxyuropterus* (*Vers. Akad. Amsterdam* (7), **2**; 1873). The "Zoological Record" for that year contains a reference to the possible identity of this species with *O. lanceolatus*, and Fowler (*B. P. Bishop Museum Occasional Papers*, **8**, No. 7, 1923, 387) includes it in the synonymy of *Masturus lanceolatus*.

3. A large specimen (2 metres in length) taken near the Azores by the Prince of Monaco (Johs. Schmidt, NATURE, **107**, 76; 1921).

4. A specimen in the Honolulu Museum recorded as *Masturus lanceolatus* by Jordan and Jordan (*Mem. Carnegie Mus.*, **10**, No. 1, 89; 1922, fig.). The authors refer to it as the third recorded specimen, but had evidently not seen Schmidt's work. A fuller account is given by Fowler ("Fishes of Oceania", *Mem. B. P. Bishop Mus.*, **10**, 474; 1928, fig.).

5. The present specimen. Like that from Honolulu, it is about 4 ft. in length.* The spotting of the caudal is much as in Fowler's figure, but only extends slightly on to the bases of the other vertical fins. The small gill opening is in the form of a short funnel, projecting backward, and there can be little doubt that it is used as an auxiliary steering apparatus by squirting out a jet of water, as suggested by Capt. Damant for *Mola mola* (NATURE, **116**, 543; 1925).

* According to Jordan and Jordan, the Honolulu cast is 4 ft. in length; presumably, therefore, this represents the length in life, but Fowler gives the length of the spirit specimen as 948 mm., or just over 3 ft.

The cartilaginous layer under the skin has a thickness in parts of about 1½ inches. The flesh was strikingly white, tender, and watery, disintegrating rapidly when scraped. In the stomach was a sucker-fish (*Echeneis remora* Linn.), 8 inches in length.

The remarks of Schmidt (loc. cit. and NATURE, **117**, 80; 1926) on the early stages of *Mola lanceolata* and allied species are of very great interest in view of the wide range from which the few known adults of *M. lanceolata* have been taken. If any specific or racial distinction could be found between these specimens, it would be logical to look for local breeding grounds. In the case of a single species, it would appear from Schmidt's conclusions that the Sargasso Sea is the nursery, and the wide distribution must be attributed solely to the action of ocean currents.

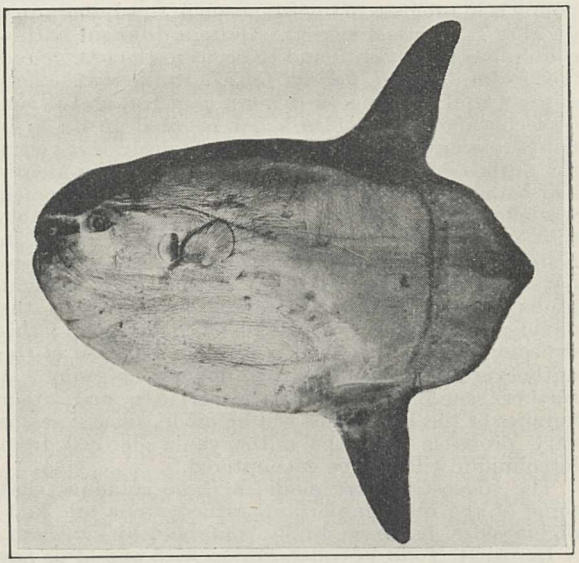

FIG. 1.—*Mola lanceolata*, from Noembing, Rhio Archipelago.

In such a case, it is difficult to believe that *Mola mola* would not be found with equal if not greater frequency over the same range. Perhaps Dr. Schmidt is in a position to suggest the true state of affairs. It would also be interesting to see the evidence for regarding the larvæ from the Sargasso Sea as those of *Mola lanceolata*. They were apparently not bred from the egg, and a very close series would therefore appear to be necessary to make certain of specific identity. In this connexion I would point out that I am handicapped by lack of literature, and have not been able to read Dr. Schmidt's detailed work ("Meddelelser fra Kommissionen for Havundersø-gelser", Serie Fiskeri, **6**, 1921), in which this latter point may be successfully met.

It seems probable that other specimens of *Mola lanceolata* have been taken and not put on record; duly authenticated notices of the capture of this species may help towards the solution of a problem of no little interest.

NORMAN SMEDLEY.

Raffles Museum, Singapore,
April 14.

### 'Powder-Post' Beetles

As a result of detailed observations supplemented by experiments, it can be stated that the actual food of the larvæ of *Lyctus* spp. (the powder-post beetles) is the *starch* present in the cells of the wood they infest. This starch is the main reserve substance of the plant, is present in the sap-wood only, and varies in quantity

from species to species of tree ; these facts explain why it is that *Lyctus* attacks only certain kinds of timber and then only the sap-wood. The starch also varies in the growing tree from month to month, and is present in greatest abundance in winter, that is, in the felling season for ' hardwoods '.

It is found that if felled timber is kept ' in the log ' sufficiently long (about a year), the starch disappears entirely from the sap-wood, and such timber is proved to be immune to *Lyctus* infestation. If, however, timber is converted soon after felling and then quickly dried, as in kiln-drying or steaming, etc., the starch remains in the sap-wood and such timber is liable to damage ; no subsequent (seasoning) treatment can remove the liability.

By seasoning susceptible species of timber ' in the log ' the pest can be controlled in a simple and inexpensive way, and its eradication from timber yards and wood-using factories is thus a practicable proposition. Damage costing many thousands of pounds a year can be saved and sap-wood made valuable, instead of being (as in oak) valueless for most purposes.

S. E. WILSON.

Royal Veterinary College,
Camden Town, N.W.1.

### Lunar Periodicity in Reproduction

A NUMBER of living organisms, particularly marine animals, exhibit a lunar periodicity in reproduction.[1] Tides do not seem to be a causal factor in this phenomenon, and it has been difficult to understand how moonlight could be responsible, since the intensity of the light of the full moon is only about 1/500,000th that of sunlight.

Various authors in the past have pointed out that the light of the moon is partially polarised, and have suggested that polarised light is the responsible factor in lunar periodicity. This suggestion has been repeated in recent letters in NATURE.[2, 3] There are no known instances, however, of polarised light affecting organisms, and the little experimental work which has been done to test this has given negative results.[4, 5] Moreover, animals and plants receive very much more polarised light from the sky during each day than they receive from the moon. The following approximate calculation makes this clear.

The area of the hemisphere of sky and the area of the full moon are respectively 20,627 and 0·196 square degrees. The intensity per unit area of the light of the full moon may be taken as being about five times the intensity per unit area of the light reflected from the day sky. Therefore,

$$\frac{\text{Total flux from sky}}{\text{Total flux from full moon}} = \frac{20{,}627}{5 \times 0{\cdot}196} = 2{\cdot}1 \times 10^4.$$

The maximum polarisation of moonlight occurs at the first and third quarters,[6] so that the maximum total amount of polarised light from the moon is received shortly after the first and before the third quarter. The light intensity of the full moon is about nine times that of half moon, so that

$$\frac{\text{Total flux from sky}}{\text{Total flux from half moon}} = 9 \times 2{\cdot}1 \times 10^4 = 1{\cdot}9 \times 10^5.$$

The maximum percentage polarisation of moonlight [6] is 9. The maximum percentage polarisation of light from the day sky is 85, and applies to the light coming from the sky 90° from the setting sun.[7] Taking a value so low as one per cent for the polarisation of light from the sky during the day, we get :

$$\frac{\text{Total polarised flux from sky}}{\text{Total polarised flux from half moon}} = \frac{1{\cdot}9}{9} \times 10^5 = 2{\cdot}1 \times 10^4.$$

It is evident, therefore, that very much more polarised light is incident on the earth during the daytime than on moonlight nights.

Moreover, even if the polarised light of the moon could cause a reproductive rhythm, this would be a bilunar, not a lunar, cycle, for the maximum polarisation is at the first and third quarters.

Recent experimental work,[8, 9] however, on the influence of light on sexual periodicity in general, suggests a way in which moonlight might impose a lunar periodicity. In mammals and birds the length of the breeding season appears to depend in part on the daily number of hours during which the animals are exposed to light. Thus the moon may perhaps cause a lunar cycle in reproduction, not through its relatively small intensity of light as compared with that of the sun, but by the additional total number of hours of illumination per 24 hours at full moon, over and above a threshold light value. Only experimental work can test this hypothesis.

H. MUNRO FOX.

Zoological Department,
University of Birmingham,
June 3.

[1] Fox, *Proc. Roy. Soc.*, B, **95**, 523 ; 1923.
[2] Cunningham, NATURE, **129**, 543, April 9, 1932.
[3] Philip, NATURE, **129**, 655, April 30, 1932.
[4] Crozier and Mangelsdorf, *J. Gen. Physiol.*, **6**, 703 ; 1924.
[5] Naviez and Rubenstein, *J. Biol. Chem.*, **80**, 503 ; 1928.
[6] Lyot, *C.R. Ac. Sc.*, **178**, 1796 ; 1924.
[7] Tichanowsky, *Phys. Z.*, **28**, 252 ; 1927.
[8] Baker and Ranson, *Proc. Roy. Soc.*, B, **110**, 313 ; 1932.
[9] Bissonnette, *Proc. Roy. Soc.*, B, **110**, 322 ; 1932.

### A Genus of Ranunculaceæ hitherto Unrecorded for New Zealand

DR. W. A. SLEDGE, of the University of Leeds, who has recently brought home from New Zealand a collection of dried plants, kindly allowed me to look through his surplus stock of species belonging to *Ranunculus* and to take what flowers I liked for examination, as I am especially interested in the petal of this genus. One species, *Ranunculus tenuicaulis* Cheesem., appealed to me particularly on his information that he had noticed it when growing to have reddish flowers. Red colouring is unusual among buttercups.

On soaking out the two flowers available, I found on investigation that there was no sign of a double perianth. Thinking possibly that the sepals might have fallen, as these flowers were fully mature, Dr. Sledge supplied me with younger ones from his mounted sheet. These likewise showed a simple (monoseriate) perianth. Further, there was no indication of any nectary on the perianth segment or tepal, to use a non-committal term. The petal of *Ranunculus* is invariably characterised by the possession of such. The perianth, then, of this interesting plant is probably a petaloid calyx of five sepals. The small flower is borne singly on a short stalk arising from a whorl of three somewhat foliaceous bracts suggestive of the involucre of *Anemone*. The carpel is of a type quite unusual for *Ranunculus*, having a long spirally recurved style. The material at my disposal has scarcely been sufficient to ascertain definitely as to the exact manner in which the ovule is borne, but such evidence as has been obtained points strongly to a suspended rather than a basally attached one. Dr. Sledge has since satisfied himself that the ovule is suspended.

The examination of these flowers, then, certainly rules out *Ranunculus* as the genus to which this plant belongs, and suggests that the *Ranunculus tenuicaulis* of Cheeseman may be a species of *Anemone*. At any rate, it is a member of a Ranunculaceous genus hitherto unrecorded for New Zealand. So far, the only genera of this attractive family occurring in these islands are *Ranunculus* itself, by far the largest

with some 40 species, *Clematis* (9 spp.), *Myosurus* (one sp.), and *Caltha* (2 spp.).

The question naturally arises: How came the late Mr. T. F. Cheeseman to place this plant in the genus *Ranunculus*? Dr. Sledge in the letter below sheds some light on this. He hopes to secure more material of this interesting plant, and when it is available, we may then be able to determine exactly its systematic position. JOHN PARKIN.

Blaithwaite,
Wigton, Cumberland,
May 25.

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I MAY perhaps supplement Mr. Parkin's interesting observations on *Ranunculus tenuicaulis* Cheesem. This montane species is rare throughout New Zealand and of most frequent occurrence in Otago, in which province I collected it. Single stations are also given in Cheeseman's "Manual of the New Zealand Flora" (Ed. 2, p. 442) for Canterbury and Nelson, whilst in the North Island the plant has been collected in the Tararua Mts. The plant was first collected by Cheeseman in 1883 at Arthur's Pass in the Southern Alps of Canterbury, and there are single authentic specimens of this gathering in the herbaria at Kew and the British Museum. We are indebted to the authorities at Kew and the British Museum for descriptions of these plants, both of which are in ripe fruit and lack perianth members, as does a second specimen at Kew collected by Kirk in the same locality a year later. In his original description of the species (*Trans. N.Z. Inst.*, vol. 17, 1884) Cheeseman writes, "Petals not seen"; and the inadequate references to the flowers in later descriptions in the "Manual", and particularly the absence of any reference to the very unusual and pronounced reddish colour of the perianth, would suggest that he never saw the plant in flower. His description of the achenes is more complete, and in the second edition of the "Manual" he adds the following note: "A very curious species, remarkable for the fusiform achenes and long spirally recurved styles". These "remarkable" facts are significant in view of Mr. Parkin's observations and the probable affinity of this plant with the genus *Anemone*. W. A. SLEDGE.

Botany Dept.,
University, Leeds,
May 25.

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### Reconstruction of an Indian Fossil Cycad

IN 1900, Prof. Seward showed, in a specimen found at Amrapara in the Rajmahal Hills, pinnate leaves resembling *Ptilophyllum cutchense* McCl. sp. organically attached to a cycadean stem of the *Bucklandia* type.[1] A *Williamsonia* flower discovered near the same locality a few years ago by Mr. G. V. Hobson of the Indian Geological Survey, and kindly placed at my disposal for description, proves to have belonged to the same plant as the *Bucklandia*. The stele of the peduncle shows that the wood is compact, as in the *Bucklandia*, and the structure of the bracts is identical in every way with that of the rhomboid leaf-bases preserved round the stem, which I have compared at the British Museum with kind permission of the authorities. There is also complete identity in structure with certain fragments of a *Williamsonia* flower, associated with another *Bucklandia* stem from Amrapara, described by Dr. N. Bancroft.[2] The flower is unisexual and ovulate; in structure it closely resembles *W. scotica* Sew., from the Jurassic of Sutherland.[3]

In a restoration which I have attempted, the plant has the habit of a miniature *Cycas*, with the surface of the stem covered by alternating zones of large and small rhomboid scars. The flowering shoots are shown projecting laterally from the columnar trunk, attached by an attenuated base and turned upwards, like the vegetative buds of the living genus. The name *W. Sewardiana* has now been proposed for the plant in supersession of the name *W. Sewardi* previously chosen,[4] as the latter name is preoccupied.

In view of our knowledge of the anatomy of the leaves, stem, and flower, this is now the best known species of *Williamsonia*. B. SAHNI.

University of Lucknow,
April 28.

[1] Jurassic Flora, "Brit. Mus. Cat.", 1900; "Foss. Plants", **3**, 488, 489; 1917.
[2] *Trans. Linn. Soc.*, p. 76; 1913.
[3] *Trans. Roy. Soc. Edin.*, **203**, 101; 1912.
[4] See Seward, "Plant Life", p. 356; 1931.

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### The *p*H Stability Region of Proteins and Osmotic Swelling

THE swelling of protein gels and tissues under the influence of acid or alkali is due mainly to osmotic forces set up on account of salt formation between the protein and the acid or base. Osmotic swelling always shows two well-marked maxima, one in the acid and one in the alkaline range, and it has generally been taken for granted that the *p*H-swelling curve should also show a sharply marked minimum corresponding to the iso-electric point of the protein. This misconception has arisen from the fact that the bulk of the work on the swelling and osmotic pressure of proteins has been done on gelatin and albumin, both of which

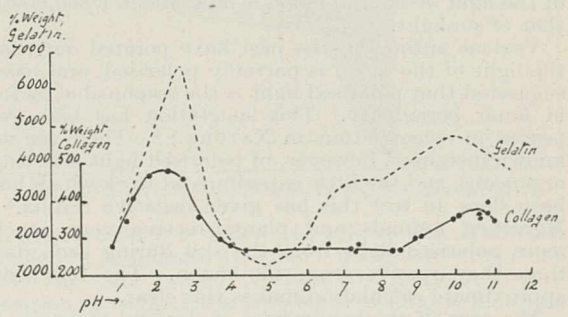


FIG. 1.

show sharply marked minima, and where it is not unreasonable to assume that the protein molecules are present without any orientation.

A very different state of affairs manifests itself, however, in protein structures, where there is evidence that the protein molecules are oriented on a definite system, generally lying parallel to each other, with the possibility of cross linkages. Examples of the effect of hydrogen ion concentration on swelling of proteins of this type show the appearance of a range of *p*H stability which becomes more emphatic with the development of a definite fibrous structure; muscle proteins, for example, have a stability range (roughly measured) of *p*H 5–7 or possibly 8.[1] The *p*H-swelling curve for collagen fibres is shown in the accompanying diagram (Fig. 1), together with the smoothed curve for gelatin. The contrast is striking, the curve for gelatin showing a sharp minimum at *p*H5 and that for collagen fibres a stability range of *p*H 4–8·5.

Keratin fibres (horse-hair) and silk fibres do not show osmotic swelling at any *p*H value, but begin to show swelling due to the breakdown of the structure by alkali at about *p*H 11–13. Speakman[2] has, however, shown that keratin fibres (wool) have a stability region against stretching forces of *p*H 4–8, and has

compared the stability range of wool keratin to the stability of protein aggregates described by Svedberg.[3] For serum albumin, the stability found by the ultra-centrifuge extends from *p*H 4 to 9; for serum globulin from 4 to 8—this range is remarkably like the range of osmotic stability found in protein tissue.

Since osmotic swelling may, with considerable justification, be attributed to the formation of a colloidal ion by the protein, due to the formation of charge centres at the free amino or carboxyl groups, it appears that most native proteins have a tendency to form oriented aggregations so arranged that the attraction between the opposite charge centres is at a maximum. In other words, the molecules form cross linkages which are not readily opened up by slight changes in hydrogen ion concentration, and a stability region of *p*H becomes apparent. This molecular structure is not, however, stable towards all forces causing hydration of the protein. Collagen fibres resemble gelatin in showing marked swelling in salt solutions over the region between the iso-electric point and absolute neutrality. Keratin and silk fibroin do not show this salt action, possibly because the side spacings between the long protein molecules are so small that even the small molecules of electrolytes find difficulty in penetrating.

D. JORDAN LLOYD.

The Laboratories of the British Leather Manufacturers' Research Association,
May 25.

[1] D. Jordan Lloyd, *Proc. Roy. Soc.*, B, **89**, 277; 1917.
[2] NATURE, **127**, 665; 1931.
[3] *Kolloid Z.*, **51**, 10; 1930.

## The Velocity of Light

IN NATURE for April 4, 1931, M. E. J. Gheury de Bray points out that the determinations of the velocity of light made in this century seem to tend towards smaller and smaller values the more recent the time of observation.

In this connexion the following remarks on the measurement of the standard metre in terms of the wave-length of the red cadmium line may be of interest. If $L$ and $f$ represent, respectively, the length of the metre and the number of wave-lengths, $\lambda$, contained in it, we may write

$$L = f_1\lambda_1 = f_2\lambda_2 \quad . \quad . \quad . \quad (1)$$

where the subscripts 1 and 2 refer to two different epochs. It is assumed that there is no intrinsic change in $L$ between the two observations. If we also suppose that the frequency of the light, $\nu$, has remained constant but that $c$ has varied, then

$$\lambda_1 = \frac{c_1}{\nu},\ \lambda_2 = \frac{c_2}{\nu}, \quad . \quad . \quad . \quad (2)$$

whence

$$\frac{f_1}{f_2} = \frac{c_2}{c_1}. \quad . \quad . \quad . \quad (3)$$

Since the figures quoted by Mr. de Bray show a decrease in $c$ of about 200 km./sec. between 1902 and 1928, an amount many times larger than most of the indicated probable errors, there may be a real difficulty. With this in mind, it is of interest to see what can be obtained from equation (3). So far as I am aware, there have been two determinations of the standard metre in terms of the red cadmium wave-length, and, quite recently, a similar measurement of the standard yard, by Tutton.[1] The observations on the metre, quoted by Tutton, are

| | | |
|---|---|---|
| Michelson . . . | 1,553,163·50 ($f_1$) | 1892 |
| Fabry, Perot, and Benoit | 1,553,164·13 ($f_2$) | 1906 |

During the interval of fourteen years $c$ would have changed by something like 1/3000, if its present apparent rate of decrease were constant. The difference in the two values of $f$ is, however, negligible, and, moreover, Tutton's own measurements on the yard, when converted to the metre by a factor obtained by non-interferential methods, very strongly support the conclusion that the number of wave-lengths of a given line contained in a given length does not vary with the time.

Thus, taking all the observations at their face value, the situation is that $f_1 = f_2$ while $c_1 \neq c_2$. From these it follows that $\nu$ must depend on the time in a manner such that $c_1/\nu_1 = c_2/\nu_2$. Since in classical dispersion theory the index of refraction depends on the ratios of the frequency of the incident light to the natural frequencies of the charges in the body, this last relation might be expected to give rather curious results when observations are made from time to time with a prism spectrograph. None, however, has been reported.

If $c$ does ultimately turn out to be constant, it will be important to investigate the discrepancies between the values hitherto published, in order that they may be used in the final mean. On the other hand, if $c$ depends on the time, we may not unreasonably expect such a variation to appear in experiments other than those which give direct measurements of the velocity.

OLIN C. WILSON.

Carnegie Institution of Washington,
Mount Wilson Observatory,
May 10.

[1] *Phil. Trans. Roy. Soc.*, A, **230**, 293; 1931.

## Climate of Southern Rhodesia

A NOTE on the "Climate of Southern Rhodesia" appears in NATURE of April 2, page 515, based on the Annual Report of this office for the year 1929–30. This notice of our work is much appreciated, but we regret that "E. V. N." has based a revival of the 'south-east trades' theory on the published rainfall maps.

Forecasts based on daily weather maps have been issued by this office for the last ten years. The general rains are of monsoonal character and are associated with the onset of north to north-easterly winds between the semi-permanent high of the Moçambique Channel and the equatorial low in the west.

Recent extension of the weather map has indicated that these winds traverse the tropical portion of the Indian Ocean. The humid north-easterly winds are interrupted from time to time by the invasion of cold air from the south-east in front of a high advancing up the east coast. The zone of discontinuity has marked frontal characteristics, and its passage is accompanied by squalls and thunderstorms, frequently succeeded by drizzle. These highs usually become stationary with their centres near 20° S. latitude, and give spells of fine weather, with light east winds. Apart from the precipitation at the discontinuity formed by the onset of the south-east winds, the rain associated with these winds is purely orographic and small in amount.

The presence of tropical cyclones near Madagascar is usually associated with a diminution of rain in Southern Rhodesia, apparently due to the interruption of the rain-bearing air currents, but a local cyclone which created havoc at Beira in 1929 was undoubtedly the prime cause of a period of heavy rain so far inland as Livingstone.

NOËL P. SELLICK
(Meteorologist).

Irrigation Division,
Department of Agriculture,
Salisbury, Southern Rhodesia,
April 23.

I HAVE read Mr. Sellick's letter about the rainfall of Southern Rhodesia with great interest. It was certainly not my intention to revive a theory of the origin of Rhodesian rainfall that has been disproved. My source of information was Kendrew's "Climates of the Continents" (1922). Kendrew makes a statement (p. 72 of that work) that implies that the monsoonal indraught in the South African summer is fed by the south-east trades, for he refers the moisture to evaporation over the South Indian Ocean. The case against this, it appears, rests upon a consideration of the trajectories of the inflowing air streams and not on the geographical distribution of the normal summer rainfall, for the ordinary diminution of rainfall (after elimination of the orographical factor) with distance from the coast would presumably be shown, whether the indraught were an eddy in the south-east trades or an eddy in a north-west current representing deflected north-east trades that have crossed the equator. Kendrew admits that in summer the north-east trades reach the north-west of Madagascar as north-west winds. The extended charts referred to by Mr. Sellick evidently show that these are then drawn into Southern Rhodesia during the monsoon. It is hoped that this important fact will be mentioned in future works on climatology.

E. V. N.

### Spectrographic Observations of Infra-Red Lines in the Auroral Spectrum

I HAVE read with great interest Prof. L. Vegard's recent communication [1] on this subject, in which he reports that in the auroral spectrum in the infra-red he has found two bands, a strong one at λ7883 A. and a weak one at λ8095 A., with sharp edges towards longer wave-lengths. Prof. Vegard considers that if the auroral green line is to be identified with the oxygen line at 5577 A., it is expected that other oxygen triplets, 7772-74-75, 8233-30-22, 7952-50-47, and 7481-79-77, will appear in this region, but none of these could be identified with the observed auroral lines. Taking into consideration the high intensities of these two bands, and the emission of the second positive bands of nitrogen in the auroral spectrum, he has interpreted these two bands as the appearances of the first positive bands of nitrogen with the special distribution of intensity.

In the course of investigations on the distribution of the intensity in the α-bands of active nitrogen, I have studied also the distribution of the intensity in the first positive bands in the case of passing an electric discharge of very weak current through nitrogen at low pressure and cooled with liquid air, and it was found that the bands due to the transitions from the initial levels which correspond to the vibrational quantum numbers 7 and 6 in the $B(^3\pi)$ state of nitrogen molecules are enhancingly emitted in the first positive bands. With reference to the results above described, the two bands which Prof. L. Vegard has found seem to be identified with the bands at 7896-80-58 (7→6) and 8047-30-08 (6→5) respectively in the first positive bands of nitrogen, though there are some differences in the wave-lengths. It may be considered that the experimental conditions above described are very close to those in the aurora with respect to pressure, temperature, as well as the conditions of weak excitation, and as a consequence of the Franck-Condon principle there will result fair concentrations of the excited nitrogen molecules in the vibrational levels corresponding to the quantum numbers $v' = (\sim 11)$, 7 and 6 in the $B(^3\pi)$ state. Therefore it is expected that in the infra-red region the bands due to the transitions (7→6) and (6→5) will be emitted intensely, and these two bands will be identified with the bands which Prof. Vegard has reported and nicely interpreted ($n_1 \rightarrow n_2 = 7 \rightarrow 7$).

The detailed description of the experimental results will be published shortly elsewhere.

H. HAMADA.

Physical Institute,
Sendai, Japan,
May 13.

[1] NATURE, **129**, 468, March 26, 1932.

### Liquid Carbon Dioxide in the Depths of the Ocean

A PARAGRAPH in NATURE of April 23, p. 607, refers to a paper in which the Russian geologist W. Vernadsky states that carbon dioxide is in a stable liquid state in the depths of the ocean. He assumes that this may be the reason why there are no appreciable amounts of plankton below about two hundred metres. It must be remarked that the carbon dioxide is physically dissolved in the sea water, therefore the laws of gases do not apply. The pressure would only be of importance if springs of carbon dioxide exist on the bottom of the deep sea; in this case the carbon dioxide would issue as a liquid but quickly be dissolved by the water. According to the results of the *Meteor* expedition, it seems highly improbable that such sources of carbon dioxide are present in the ocean—at least, in the Atlantic.

However, the pressure causes an effect on the carbonic acid. The dissociation of this acid rather increases with the greater depths. The deep water is more acid than the shallower, provided the carbon dioxide content is the same.[1]

Concerning Vernadsky's conclusions, it may be mentioned that Hentschel [2] found considerable amounts of phytoplankton down to several thousand metres. Further, that the oxygen in the bladder of deep-sea fishes may be the result of a decomposition of liquid carbon dioxide seems quite impossible in view of the energy needed for this reaction.

H. WATTENBERG.

Institut f. Meereskunde,
Berlin, May 28.

[1] Cf. K. Buch, H. W. Harvey, H. Wattenberg, and St. Gripenberg, "The $CO_2$ System of Seawater", *Rapp. et Proc. Verb. Cons. Internat. pour l'explor. de la Mer*; 1932.
[2] *Ber. d. "Meteor" Expedition*, 2, Ges. f. Erdk. Berlin; 1927.

### Meteorite Craters

THE very interesting article by Dr. L. J. Spencer on "Meteorite Craters", in NATURE of May 28, suggests a possible explanation of the fact that, while the bedding of the surrounding country may be horizontal, the strata exposed in the inner walls of the crater usually dip radially outwards from the centre.

The air photograph of the Cañon Diablo crater reproduced in the article bears a close resemblance to the well-known 'splashes' produced at the surfaces of armour-plate by the impacts of projectiles. The analogy between such 'splashes' and those of drops falling into liquids was pointed out by Roberts-Austen in *Fielden's Magazine* of August 1899.

It may be of interest to recall that A. M. Worthington was the first to synchronise photographic records with the movements occurring during the 'splash of a drop'. His classical work formed the subject of a discourse at the Royal Institution in May 1894.

S. W. SMITH.

Royal Mint,
London, E.C.3,
June 6.

## Research Items

British Hanging Bowls.—In *Antiquity* for June, Mr. T. E. Kendrick has published a study of the hanging bowls of bronze with special reference to their position in the cultural history of Britain. Hanging bowls, already known in Britain in La Tène times, returned into fashion in the second half of the Roman period. An approximate date of A.D. 400 is suggested for the hiding of a hoard found at the Romano-British settlement at Irchester. The most decorative bowls are those fitted with escutcheons in the form of enamelled discs. They may be grouped under three sub-headings: (i.) The 'Romanising' series; (ii.) the 'ultimate La Tène' series; and (iii.) the 'developed trumpet-pattern' series. In the Romanising series, the escutcheons show the inspiration of classical ornament and come down possibly to a date not later than 500 B.C. The 'ultimate La Tène' series is the work of craftsmen who were still resolutely Celtic, and had no sympathy with Roman and contemporary continental design. They represent the continuation of the native enamel work of the north. The Barlaston bowl and the Northumberland escutcheons, which belong to this class, cannot be later than A.D. 300. The contrast with class iii., the 'developed trumpet-pattern' series, is very striking. Here the work is primarily concerned with the modifications of the late Roman pelta trumpet-patterns, which are transformed with all the grace of the British artist. These decorative designs later became the stock-in-trade of the illuminator; and it is suggested that they are not the renaissance of an ancient Celtic art, but an independent Celtic experiment which developed a borrowing from late Roman art. Although the bowls are for the most part found in Saxon graves, they were loot; and the Saxons probably contributed nothing to their manufacture.

Palæolithic Art in the Grotte d'Isturitz.—M. le Comte Réné de Saint-Périer has described (*L'Anthropologie*, **42**, Nos. 1-2) two remarkable examples of palæolithic art which have been discovered in the course of excavating the inner chamber of the Grotte d'Isturitz (Basses Pyrénées). They are derived from a lower Magdalenian stratum without harpoons, above which are, possibly, two Magdalenian strata in which harpoons appear. One of the objects is a sculptured bear in limestone, 51 mm. high by 20 mm. thick. Great care has been given to the proportions of the figure. The limbs have been broken off by an ancient fracture almost level with the body. The sculpture is charming in its correct representation of the characteristic modelling, attitude, and expression of what is clearly *Ursus arctos* and not *Ursus spelœus*. The second object is of bone, 120 mm. by 20 mm. by 2 mm. thick. The ends are broken off. It is engraved on both sides. On one side is a bison of fierce aspect, realistically engraved to show the distribution of the hair. Two harpoons or barbed javelins are in its flank, and two columns of hot breath issue from its nostrils as it follows another bison, of which the hind-quarters have just survived the fracture. On the other side, two crudely engraved human figures, male and female, appear, which in their relation one to another are unique in palæolithic art. The woman, whose head is broken off, is fat but not enceinte. Hair is shown freely distributed over the abdomen, thighs, and the one breast visible. Bangles encircle one ankle; a barbed javelin head appears on the right thigh; and the arms are raised as if in prayer. The man, of whom half remains, is in the same attitude with arms upraised and face looking up towards the woman above his head. He wears necklaces and bracelets.

Identical Twins reared Together.—The studies of Dr. H. H. Newman on twins reared apart (see NATURE, May 7, p. 692) are to some extent supplemented by Mr. Harold D. Carter's account (*J. Heredity*, vol. 23, No. 2) of identical twins reared together. In Case 1—boys of fourteen years of age—one of them reads more and appears somewhat brighter; but it is not clear whether he is brighter because he reads more, or reads more because he is brighter. The Siamese twin girls aged fourteen years studied by Dr. Helen Koch were found to differ distinctly in intellect and achievement, but the differences are less than in most twins. Such differences are regarded as innate and not environmentally produced. In Case 3 (brothers of sixty years) the twins were more unlike than in Case 2 (sisters of thirty-eight years), although the similarities of environment were greater in the former case. In Case 2, the difference in ability was in favour of the twin with less favourable environment, again suggesting that a difference in mental endowment was determined internally rather than externally. In all these cases the twins were extremely alike, often mistaken for each other, and their finger patterns almost or quite identical.

Control of Leather-Jackets.—Among other articles of practical value and interest in the sixth issue of the *Journal* of the Board of Greenkeeping Research is one by R. B. Dawson, which deals with the question of the control of leather-jackets, the larvæ of *Tipula paludosa* or daddy-long-legs, which may be very destructive on golfing turf. The subject is introduced by an account of the life-history and habits of the insect, knowledge of which is essential if suitable control methods are to be found. For small, level areas, the practice of spreading tarpaulins or rubber mats overnight on grass which has been soaked with water often proves successful, as the larvæ collect at the surface. For larger areas, applications of a chemical larvicide is more practicable, and a 64 per cent emulsion of orthodichlorobenzene is specially recommended. This has proved a thoroughly trustworthy method of control, and only temporarily discolours the grass. Full instructions for making and using this emulsion are supplied, the cost of the treatment being 8*s*.-12*s*. per 500 sq. yards. Other methods involving the use of materials such as naphthalene, paris green, ammonia solutions, etc., may also be effective in controlling the pest, but they are less unreservedly recommended, as they are apt to be unreliable, and in some cases have poisonous properties.

Characteristics of Home-grown Timbers.—With the introduction of research into the mechanical and physical properties of timbers, it has been necessary not only to standardise the meaning and application of technical terms and the methods to be followed in the tests, but also to compile and publish the results in rather complicated tabular statements. In order to place this information in a form more readily accessible to those who wish to have a general comparison of our home-grown timbers in their relative strengths as developed in various types of construction and manufacture, the Forest Products Laboratory has issued *Bulletin* No. 12, entitled "Some Characteristics of Home-grown Timbers" (pp. v + 11 + 9 plates. London: H.M. Stationery Office, 1931. 2*s*. net). The publication deals with the characteristics of eight home-grown hardwoods and five softwoods: oak, ash, beech, common elm, Dutch elm, wych elm, chestnut, and poplar (*P. serotina*); Corsican pine, Douglas fir, European larch, Scots pine, and silver

fir. The strength properties of the species are compared by means of diagrams in which the height of a column denotes the degree of the property attained by the particular timber, as compared with the same property in home-grown oak; these diagrams are explained by notes, which give not only the applications of the various strengths and other properties depicted, but should also afford considerable assistance in the selection of timber for a given purpose. Besides the general comparisons above mentioned, there are graphs which show the influence of the specific gravity of a timber upon its relative strength, as well as diagrams indicating the relative shrinkages which take place in the timbers. These last are of particular interest in the case of woods for panelling, flooring, patterns, and other uses where shrinkage and the 'working' of the timber with change in atmospheric humidity are of considerable importance.

**Earthquakes, Fisheries, and Flower Fall.**—Prof. T. Terada has shown that there exists a curious relation between the numbers of earthquakes in the Idu peninsula and the numbers of fishes caught near the northern end of Sagami Bay (*Proc. Imp. Acad. Tokyo*, vol. 8, pp. 83-86; 1932). During the spring of 1930, swarms of earthquakes occurred in the neighbourhood of Ito on the east coast of the peninsula (NATURE, vol. 126, pp. 326, 971). It was found that the epochs of abundant catches of horse mackerel (*Caranx*) at the Sigedera fishing ground coincided very nearly with those of the earthquakes. This result led Prof. Terada to compare the numbers of fishes caught in the six years 1924–29 with the numbers of felt and unfelt earthquakes in and near the Idu peninsula. For the year 1928, the parallelism of the two curves was very close, though in other years it was less conspicuous. During 1928, the curve representing the numbers of immature tunny (*Thynnus*) caught shows a remarkable similarity with the horse mackerel and earthquake curves. In another paper (*Bull. Earthq. Ves. Inst.*, vol. 10, pp. 29-35; 1932) Prof. Terada points out that, though the daily numbers fluctuate, the time-distribution curve of the Ito earthquakes resembles on the whole the probability curve, and he shows that the daily number of falls of camelia flowers follows a similar statistical distribution.

**Meteorology of the North and South Atlantic.**—Continental meteorologists have in the past played an important part in the collection of information about the weather over the Atlantic. The long series of daily synoptic weather maps for Europe and the Atlantic prepared by the Danish and German Admiralties before the War were for many years without rival for completeness, and have been of constant assistance to the forecasting staff of the Meteorological Office, Air Ministry, in the study of large scale air movements and their effect upon British weather. The last section of a new contribution, of a more statistical nature but dealing with an almost equally large area—namely, the North and South Atlantic—has just been received. It has been compiled under the direction of Prof. E. Van Everdingen, the director of the Dutch Meteorological Service, and summarises about seven million observations of oceanic current, wind, barometric pressure, temperature, and cloud, covering the three months September, October, and November for the years 1870–1925, the other quarters having already been dealt with. It takes the form of a series of large charts with explanatory matter and tables (*Pub.* No. 110, Koninklijk Nederlandsch Meteorologisch Institut). It is scarcely necessary to say that such a compilation is of immense value to those engaged in a study of world weather, and that it will be a mine of information for future compilers of climatological handbooks and treatises. It includes detailed studies of the more important disturbances which are of danger to navigators of the Atlantic, such as the cyclonic depressions of the North Atlantic, the West Indian hurricanes, and the 'tornadoes' or storm squalls of the West African coasts. These last, it should be mentioned, differ greatly from the American tornadoes, which are much more violent, but fortunately also individually affect much smaller areas and are in the main land phenomena outside the scope of this work. Assistance in the supply of data has been given by the French, German, and English meteorological services; this is therefore the concluding section of a great international undertaking.

**Vacuum Distillation.**—In a paper on vacuum technique (*J. Franklin Inst.*, Feb. 1932), Dr. K. Hickman of the Kodak Research Laboratories has directed attention to the serious errors which may occur in the measurement of the saturation vapour pressure of liquids when that pressure is of the order of a millimetre of mercury. Unless the vapour pressure is measured close to the thermometer which gives the temperature, the correction for the drop of pressure from thermometer to manometer becomes of the order of the pressure to be measured. Dr. Hickman enlarges the head of the rectifying column, places the thermometer in the enlargement, and either measures the pressure there directly or by the aid of a column of the condensed liquid in a U-tube between the enlargement and the manometer. With this arrangement, he finds that the relation between log (pressure) and the reciprocal of the absolute temperature continues to be linear down to very low pressures.

**Spectrum of Lithium Hydride.**—A further analysis of this spectrum, which is one of considerable complexity, is given by G. Nakamura and T. Shidei in the *Japanese Journal of Physics* (7, p. 33). In their previous work, a large number of faint lines were not classified; in the present investigation, it has been found possible to include many of these in a band system which is attributed to the hydride ($Li^6H$) of the lighter and rarer lithium atom, but the very curious feature emerges that the relative intensities of the lines associated with $Li^6$ and $Li^7$ respectively vary with the conditions under which the spectrum is taken. This is in accord with Dempster's work on lithium with the mass-spectrograph, but not with that of Bainbridge. This spectrum has the further point of interest that it arises from two of the lightest atoms, so that it is not impossible that it may serve to check a quite full quantum theory of their combination; the theory of the normal state of the molecule has already been developed in some detail by Hutchisson and Muskat in the first May number of the *Physical Review*.

**The Electron Microscope.**—It has been known for many years that a divergent pencil of electrons can be refocused by a magnetic field. More recent investigations, which are summarised by E. Brüche and H. Johannson in *Die Naturwissenschaften* (May 20), have shown that an electric field can act similarly, and, in fact, that a complete system of electron-optics exists, with reflecting and refracting surfaces in the ordinary sense replaced by regions of field acting upon moving electrons. Brüche has demonstrated the action visually by photographing beams of electrons passing through 'electron-lenses' in gas at low pressure. In this article an account is also given of an electron-microscope which is likely to be of use technically; it is constructed much on the principle of an ordinary microscope, but with electron lenses, and shows a much enlarged image of a small electron-emitting

surface by the fluorescence of the points of impact of electrons which have passed through the ' microscope ' on to a screen. The whole arrangement is like a small optical bench set up in a vacuum vessel. Two examples of its application are given: the first, a 150-fold enlargement of a badly coated oxide cathode, showing clearly the patchy nature of the active surface, which could not have been inferred with such certainty from an ordinary optical study; and, secondly, a set of enlargements (× 65) showing the migration and final disappearance of the active centres on an overheated coated cathode. It would appear to be possible in principle, although scarcely in practice, to obtain pictures of the electron-emitting areas on the surface of the sun from experiments on the streams of charged particles which produce the aurora.

**The Wassermann Test.**—Many variations of the Wassermann test have been described, with the view of increasing its sensitiveness and rendering it more specific, thus eliminating the doubtful reactions, which are of no value to the clinician. E. J. Wyler has recently described an improvement in his routine test, by which more accurate results can be obtained (Reports on Public Health and Medical Subjects, No. 67. London: H.M. Stationery Office, 1932. 4*d*. net). In the test, the suspected serum, previously heated to 55° for 30 min. to inactivate complement, is mixed with complement (guinea-pig's serum) and antigen (alcoholic human heart extract, 3 parts, with 2 parts of a 1 per cent alcoholic solution of cholesterol) and incubated at room temperature for 30 min. and then at 37° for 30 min. A standardised suspension of sheep's red blood cells sensitised with at least six doses of hæmolytic immune body is then added; hæmolysis occurs quickly when the suspected serum does not come from a case of syphilis, but is absent or incomplete when the patient has suffered from syphilis which has not been completely cured—in other words, the Wassermann test is positive. In all tests, control tubes are put up containing serum and complement but no antigen: lysis of the sensitised red cells should be quick and complete, when added at the end of the preliminary incubation, in the presence of three minimal hæmolytic doses of complement. The variations in the method concern the amounts of complement, antigen, or serum added and the type of antigen used. The author has found that the greatest sensitiveness is attained when the amount of serum is increased from three up to five times that normally used, whilst variations in the quantities of the other reagents gave less satisfactory results. 20 per cent of sera which were negative or doubtful by the routine test gave a definite positive response with the new method. In non-syphilitic sera, there were no false positives and only 2·6 per cent were doubtful: with the ordinary test, 9·3 per cent were doubtful. The new method is also more sensitive than the flocculation or Sigma test, which itself is more sensitive than the routine Wassermann test.

## Astronomical Topics

**Two New Comets.**—A telegram from the I.A.U. Bureau, Copenhagen, announces the discovery of a new comet by Mr. Newman, who gave the following position for 1932·0:

| U.T. | R.A. | N. Decl. |
|---|---|---|
| June 20$^{d}$ 4$^{h}$ 49·4$^{m}$ | 15$^{h}$ 37$^{m}$ 16$^{s}$ | 7° 56′ |

Daily motion, − 2$^{m}$ 8$^{s}$, +44′: Magnitude, 13·0

From observations on June 1, 7, and 20, Whipple and Cuningham have determined the following elements:

$T$ = 1932 Sept. 27 U.T.
$\omega$ = 73° 50′
$\Omega$ = 244 50 } 1932·0
$i$ = 76 50
$q$ = 1·57

The following ephemeris is for 0$^{h}$ U.T.:

| | R.A. (1932·0). | Decl. (1932·0). |
|---|---|---|
| June 30 | 15$^{h}$ 20$^{m}$ | +14° 0′ |
| July 4 | 13 | 16 10 |
| 8 | 15 8 | 18 10 |

The following observations have been made by Dr. W. H. Steavenson with his reflector at West Norwood. Equinox 1932·0:

| | | R.A. | | Decl. | | |
|---|---|---|---|---|---|---|
| June 21$^{d}$ | 23$^{h}$ 9·7$^{m}$ | 15$^{h}$ 34$^{m}$ | 3·1$^{s}$ | + 9° | 4′ | 42·6″ |
| 22 | 23 9·5 | 15 32 | 10·2 | + 9 | 43 | 48·0 |
| 25 | 0 19·3 | 15 28 | 26·5 | +10 | 51 | 16·9 |

The B.D. position of the comparison star, B.D. + 9° 3075, was used. The comet preceded it by 1·0$^{s}$, and was 7′ 19·1″ north of it. The diameter was 1′, and there was a nearly stellar nucleus of magnitude 12. The approximate daily motion indicated is about − 1$^{m}$ 41$^{s}$, + 38′. The comet is well placed for observation.

A Reuter's telegram from Wellington, New Zealand, announced the discovery of a comet of the 10th magnitude by the New Zealand Government Astronomer; the message was dated June 23, but the discovery was presumably on June 22 by U.T.

R.A. 9$^{h}$ 15$^{m}$ decreasing.
S. Decl. 84° 36′ decreasing.

This makes the seventh cometary discovery of the year, including the van Biesbroeck object of March 6, which was not seen again. Two of the seven (Grigg-Skjellerup and Kopff) were the returns of periodic comets; the others appear to be new comets.

**The Coming Total Solar Eclipse.**—An article by Dr. A. V. Douglas (*J. Roy. Ast. Soc. Canada*, May–June) gives information about the arrangement of parties to observe this eclipse, and suggests how amateurs can help. Observations of the exact limits of the path of totality are suggested; this was satisfactorily carried out in the eclipse of January 1925; also observations of the shadow-bands, of the fall of temperature, and of the degree of illumination during totality (by seeing at what distance small type can be read). It is also suggested that wireless experts may study the effect of the eclipse on radio-transmission. Dr. Douglas gives a list of coming totalities; but, curiously, as in several lists, the favourable eclipse in Norway on July 9, 1945, is omitted; this is a return of the British eclipse of 1927, but with a higher sun and longer totality. Prof. C. A. Chant, in the same journal, gives details of the location of the various parties of observers. Dr. J. Jackson and Mr. C. R. Davidson from Greenwich, with Dr. Knox Shaw, are going to Parent, north of the St. Lawrence; Prof. F. J. M. Stratton to Magog, on the south side of the River; Profs. A. Fowler and H. Dingle will observe from McGill University, near the edge of the belt of totality. A party from the Royal Astronomical Society will go to a station in Maine. Nearly all the great American observatories are sending parties, and others are going from Japan and Pulkovo. Given fine weather, it should be one of the best observed eclipses on record. A map of the portion of the track from the St. Lawrence to the Atlantic is given in the B.A.A. Handbook for 1932.

## New Methods of Research in Aeronautics

THE twentieth Wilbur Wright memorial lecture, delivered before the Royal Aeronautical Society by Mr. H. E. Wimperis, on May 26, under the above title, is of twofold interest to scientific readers. It gives an account of the work now in progress in aeronautical research. It also includes a more abstract discussion upon the aims of aeronautical research in Great Britain, the difficulties that confront it—not the least of which are those of finance—and the methods by which it is hoped they will be overcome.

Mr. Wimperis began by commending the methods of the Wright brothers as being the soundest in scientific research. They "made thousands of tests . . . and tabulated thousands of readings". Few persons actually engaged in research will quarrel with that commendation. The paper then describes the organisation of aeronautical research in Britain, and pays tribute equally to the progress made by the scientific workers and to the aircraft industry's ability in utilising information so obtained. Mr. Wimperis scarcely gives full credit to Britain for its relative contribution to the world's aeronautical knowledge; in fact, he more than once apologises for the inadequacy of the equipment, both in use and proposed. It is hoped to be able to use this limited amount of apparatus for the unhindered solution of various problems, by skilful adaptation, and extending results so obtained upon a basis of mathematical and physical reasoning.

The new British compressed air tunnel will be able to obtain a Reynolds number 1·93 times that of the only other one in existence in the U.S.A., by working at an air pressure of 25 atmospheres. The solution of many of the problems met in the course of the development of this apparatus has been very materially helped by the full and free communication of all available information from the National Advisory Committee for Aeronautics in America. Incidentally, the policy of delaying the building of this tunnel until the U.S.A. Committee had fully explored theirs has been fully justified, and the truly international aspect of scientific research, when unhampered by political affairs, is emphasised.

The large wind channel to be erected at the Royal Aircraft Establishment at Farnborough is to be only 24 ft. diameter, against the 60 ft. × 30 ft. cross section of a similar one in America, and will use 2000 h.p. for air propulsion, as compared with 6500 h.p. in the large American tunnel. It will thus be cheaper both in first cost and running expenses. A 24-ft. tunnel can be used to investigate all problems that must inevitably be so done, that is, those incapable of being attacked by direct full scale experiments during flight. These are all connected with the central part of an aeroplane, principally the cooling of engines, resistance of the body and its parasitic parts, and the investigation of airscrews. Problems upon the behaviour of the actual wing structure can be, and have been, successfully measured in full scale flight on a special Parnall research monoplane, and such results can be added to those found in the tunnel for the more complex parts around the body.

A vertical wind tunnel for the investigation of spinning is also described. The air in this moves upwards, so that the spinning model, while falling relative to the air, is actually kept in the plane of observation and measurement by the operator. These experiments raise extremely complex problems upon the validity of transferring results from models of one size to another, or comparing results at different speeds, because of differences in mass, moments of inertia about various axes, etc. The effect of the sudden movement of control surfaces is reproduced by a delay action mechanism incorporated in the model.

The visual examination of air flow has obvious uses in aeronautical research. This is accomplished by the introduction of smoke from titanium tetrachloride for slower speeds. For higher speeds, shadowgraphs are taken from air heated by passing it across an electrically heated wire and viewing the model in its wake, either stroboscopically or photographically. When conditions are analogous, water can be used, and the motion examined either by watching illuminated oil bubbles or by focusing a microscope upon 'objects' in the water.

Experiments upon the suppression of noise are of interest not only for themselves, but also for the necessary development of the technique of the measurement of noise in 'decibels'. Considerable progress has been made in the insulating of the interior of an aircraft cabin from noise, but not so much upon the suppression of the noises at the source.

An ambitious programme of work on flying boat hulls and floats is outlined for the new tank at the R.A.E., Farnborough. Although the size of the tank is being limited, it is hoped to investigate all that is necessary by examining the behaviour of the model during the inevitable acceleration and deceleration in each run. It so happens that these are the two periods of greatest interest to designers, as the only parts of a seaplane's normal travelling life on the water are spent in either of these operations. Here again there will be considerable mathematical difficulties concerned with problems of mass, acceleration, and dynamical similarity.

The address concludes with a tribute to all those who have been concerned with the work of producing and handling machines for the Schneider contest. Mr. Wimperis expresses his satisfaction that these competitions have now automatically ceased, as the risk to the flying personnel was out of all proportion to the value of any results likely to be obtained from the mere further increase of flying speed alone. Nevertheless, the value of the technical progress that has been made in this respect is not to be underestimated.

## Early Maya Culture in Northern Yucatan*

COBÁ, if only on account of its size, is one of the most important centres of culture in the Maya area of Central America. If, and when, its ruins are excavated, it is not improbable that it may prove crucial in the solution of a number of obscure problems connected with early Maya colonisation in northern Yucatan. Since its ruins were discovered in 1926 by Dr. T. W. Gann—it was not then known that it had been visited by Teobert Maler in 1891 five further expeditions of the Carnegie Institu ion have been engaged in exploration and survey work on the site.

Cobá, which is situated in the Mexican province of Quintana Roo in the north of the Yucatan Peninsula,

* A Preliminary Study of the Ruins of Cobá, Quintana Roo, Mexico. By J. Eric Thompson, Harry E. D. Pollock, and Jean Charlot. (Publication 424.) Pp. vii+213+18 plates. (Washington, D.C.: Carnegie Institution, 1932.)

about 100 miles east of the ancient Maya city of Chichen Itzá, and has the largest assemblage of buildings, with the exception of Tikal, in the Maya area, is one of the few sites of which the ancient name is still known to present-day Indians. Vestiges of ancient cult and ritual still linger on before its stelæ; while the deities of Cobá are venerated in bee-keeping and first-fruit ceremonies in distant villages, where the inhabitants assuredly have no knowledge of the present-day ruins of Cobá.

The site of Cobá was especially favourable for Maya colonisation, owing to the propinquity of an ample supply of surface water in a chain of lakes, and a plentiful rainfall, which fostered the growth of vegetation and the pursuit of agriculture.

The area which has been mapped up to the present covers 9 km. from north to south and 5 km. from east to west.

To the south the ground is still unexplored, and more ruins may yet be found there. Of the surveyed area, the northern part is literally covered by ruins. Between the main groups of Cobá and Nohoch Mul there is an almost unbroken succession of mounds, culminating in a group of considerable importance associated with Nohoch Mul. The shores of Lakes Cobá, Macanxoc, and Sacakal are surrounded by mounds which, excluding those of the last-named lake, form one great site, 3·5 km. by 2 km.—certainly one of the largest in the Maya area.

One of the most striking features of Cobá is the network of artificially constructed raised roads connecting the various groups about the lakes and running off in all directions to distant sites. One of these leads to Yaxuná, a distance of 100 km., terminating only 20 km. from Chichen Itzá. These roads are raised above ground-level and, for the most part, run perfectly straight. They are built of vertical slabs of roughly dressed stone, with an inside fill of large stone, covered with smaller stone. A fine plaster surface has now weathered away.

Broadly speaking, the ruins of the Cobá district fall into two classes of construction, a superior and an inferior, which, while not differing radically, exhibit certain variations in quality of workmanship and design. A preponderance of the buildings shows a closely connected court type of assemblage with a fixed scheme of orientated groups. The Macanxoc groups, however, abandon the orientation. Such compact assemblage finds its most common expression in the Peten region of Guatemala at Tikal, Nahum, and similar sites; while Uaxactun shows a tendency to separate groups, though still with an orderly scheme of arrangement of buildings, definitely related to one another. Notwithstanding the difficulty of drawing parallels between Cobá and other areas, there are certain distinctly marked affinities with the 'Old Empire' centres to the south, which is borne out by the analysis of the art of Macanxoc, for which Mr. Jean Charlot has been responsible. At the same time, there is sufficient evidence of independence in development, especially in the unique character of the complicated system of artificially made roads, to suggest a long period of growth locally, and even possibly several occupations.

At one time or another, no less than fifty monuments have been discovered at Cobá. Of these, twenty-four are carved, twenty-three being stelæ and one an altar. The stelæ at Cobá and Macanxoc are placed in 'shrines'—stone structures consisting of a platform with back walls and short projecting side walls. Structures of this type have not been reported from any other Mayan site. It is possible that they were roofed over with thatch.

Some of the stelæ are dated in the Maya notation. Of these, the earliest is of some importance in its bearing on the spread of Maya colonisation into northern Yucatan. Hitherto it has been held, on the authority of a statement in the Book of Chilam Balam, that Chichen Itzá marks the first Maya intrusion into the area. This is dated at an equivalent in the Christian system of A.D. 452; but a dated monument at Cobá gives a date equivalent to A.D. 353, making this site at least a hundred years earlier; while the evidence of the development of style in architecture and art suggests that the original settlement was considerably older. A series of dates is now known from the three cities of Tuluum, Ichpaatun, and Cobá, ranging from A.D. 314 to 353, which points to a movement along the east coast of Yucatan, of which the terminal was Cobá, and the place from which it originated in the 'Old Empire' area of Peten, possibly at Naranjo, though on the evidence of affinities in art, Mr. J. Charlot thinks it possible that the site of origin may still await discovery.

## Sunspots, Planets, and Weather

ONE of the most interesting problems of meteorology is the relation between sunspots and terrestrial weather. In most parts of the world, including the British Isles, the relation is too complex to be readily demonstrable, and the number of unknown factors too great for it to be of use in forecasting, but in a few areas, for one reason or another, the control by sunspots becomes dominant. Mr. Inigo Jones, Director of the Bureau of Seasonal Forecasting in Queensland, believes that Australia is one of these areas under solar control, and in a recent presidential address to the Queensland Astronomical Society* he quotes a number of examples.

Mr. Inigo Jones carries the problem a stage further, however, seeking beyond sunspots for their causes. The sunspot cycle, striking as it is, is not perfectly regular, and the dates of maxima and minima cannot be forecast exactly. He believes that this cycle is caused by the movements of the planets; it is dominated by Jupiter, which has a periodicity of 11·86 years, but irregularities are caused by Saturn and to a less extent by Uranus and Neptune, and these introduce additional cycles which reduce the average length to 11·1 years. Hence he seeks for the explanation of abnormal weather not only in the sunspots themselves but also in the conjunctions of the planets. Especially important is the conjunction of all four, which occurs at intervals of 164 years and is often associated with world-wide climatic disturbance and severe famines.

The way in which sunspots operate is still a mystery, but there are many indications that the greatest effects take place high in the atmosphere, in the ozone layer, the conducting layers, and the auroral zone, and the surface effects may be of a secondary nature only. Mr. Inigo Jones describes a possible mechanism as follows: "Cyclones to which our heaviest rains are attributable are caused by discontinuities between air masses having different temperature and moisture contents, and it is clear that any upper air changes must accelerate such differences, and further, the fact that sunspots by their emanations disturb the upper air and so suddenly intensify these differences, shows easily how it is that the effect is produced, and at the initiatory or terminal stage of each sunspot's visibility". More prolonged effects may take place through the action of ozone, and investigations which

* "Seasonal Forecasting." Brisbane, 1931.

are now being made into the relations between solar radiation and ozone should throw a great deal of light on the effect of sunspots on weather.

The problem is complicated by terrestrial effects, such as the lag in changes of world temperature caused by the masses of polar ice and by the movements of powerful ocean currents, or the disturbing effects of great volcanic eruptions. All these factors will need to be taken into account before long-range forecasts can attain a really effective precision, but Mr. Inigo Jones gives a number of examples to support his view that in Australia at least the major control of weather is exerted by the sun.

## Canned Fruit and Vegetables

THE processes that made the preservation of fruit and vegetables possible were discovered in France more than a century ago, but although numerous canning factories have been in operation in several European countries, America, and parts of the British Empire, it is only during the last ten years that any have been built in England. However, 53 such factories were in operation in this country by 1931.

The quantity of canned fruit imported into England has shown an enormous increase in recent years. In view of this greater demand, the home industry has every prospect of success, provided the grower will produce the right type of fruit and vegetable. To meet this need, the Ministry of Agriculture has published an illustrated bulletin (No. 45) entitled "Fruit and Vegetable Production for Commercial Canning" (London: H.M. Stationery Office, 1*s.* 3*d.*).

Plums are by far the most important tree fruit for canning purposes, the use of cherries being somewhat restricted owing to the tendency of the juice to act on the metal container and the difficulty of finding a suitable variety. As regards the commonly grown soft fruits, the majority may be successfully canned if firm, clean fruit is selected. Up to the present, peas are the only vegetable that has been canned in any quantity, but the possibilities of extending the industry to include other vegetables are indicated.

Production for the cannery is an entirely different proposition from production for the fresh market, and it is essential that the grower should recognise this from the start. On the whole, it would seem most suited to large-scale producers with mechanical methods of cultivation, as regular, standardised consignments are required and costs must be kept as low as possible. From the long experience obtained in other countries, the desirability of contract growing is indicated. Various methods of this system are discussed, but it is evident that special arrangements will need to be worked out to meet the particular requirements of the different crops. Some such methods should, however, do much to promote the development of the industry and give confidence to the growers.

## Standardised Preparations of Vitamins A and D

WE are glad to note that British manufacturers have taken full advantage of the recent striking advances in our knowledge of the fat-soluble vitamins A and D and have now available for general clinical use standardised preparations of these highly important substances. The isolation of calciferol (vitamin D) by Dr. Bourdillon and his collaborators has been followed in a remarkably short space of time by its preparation on a commercial basis by British Drug Houses, Ltd., who are to be congratulated on the rapidity with which they have translated a delicate laboratory process to a works' scale. This firm now supplies, under the name of Radiostol Solution and Radiostol Pellets, pure crystalline vitamin D. The solution, the activity of which is such that one fluid ounce is equivalent to fifty fluid ounces of cod-liver oil, is a tasteless preparation of the pure vitamin in oil, while the pellets contain it incorporated in cocoa butter, one pellet being equivalent to a full adult dose of cod-liver oil.

Another physiologically standardised vitamin D product, sold under the brand name of Ostelin, emanates from the Glaxo Laboratories (Joseph Nathan and Co., Ltd.). This preparation, which was originally manufactured in 1924 from cod-liver oil but is now prepared by the carefully controlled irradiation of ergosterol, is also supplied in both liquid and tablet forms. Ostelin liquid, which is standardised to contain 5000 international units of vitamin D per c.c., is tasteless and miscible with water, and can therefore be dispensed in pharmaceutical mixtures. The tablets contain, in addition to 500 units of vitamin D each, neutral calcium glycerophosphate.

More recently the Glaxo Laboratories have also put on the market, under the brand name of Adexolin, a mixed preparation of both vitamins A and D in proportions normal to cod-liver oil. Adexolin is available both as liquid and capsules. The special feature of the liquid, a fluid oz. of which is equivalent in both vitamins to 20 fluid oz. of good cod-liver oil, is that as a result of a special process it is largely free from the objectionable taste of ordinary fish-liver oil concentrates. The capsules have been designed to allow the administration of larger quantities of the two vitamins than is necessary for infants. The prophylactic dose for adults is usually 1–3 capsules per day, but in cases of acute septicæmia complicated by high febrile conditions, so many as 24 capsules per day can, we are informed, be administered with highly favourable results.

## University and Educational Intelligence

BIRMINGHAM.—The degree of D.Sc. has been awarded to T. L. Ibbs for various papers on thermal diffusion and the form and field of force of the carbon dioxide molecule and allied subjects.

LONDON.—Mr. J. L. S. Hatton, principal of East London College, has been elected vice-chancellor for 1932–33 in succession to Dr. J. Scott Lidgett, whose term of office expires on Aug. 31. Dr. W. R. Halliday, principal of King's College, has been appointed deputy vice-chancellor for the same period in succession to Canon Douglas.

Prof. D. T. Harris, since 1921 assistant professor in the Institute of Physiology at University College, has been appointed professor of physiology (London Hospital Medical College) as from Oct. 1.

The title of University reader has been conferred on Dr. Evelyn E. Hewer, lecturer in histology at the London (R.F.H.) School of Medicine for Women.

OXFORD.—Among the honorary degrees conferred on June 22 were the following: D.Sc. on Sir John Russell, director of the Rothamsted Experimental Station, and Prof. Willem de Sitter, professor of astronomy in the University of Leyden; D.C.L. on Sir Arthur Salter, recently director of the Economic and Finance Section of the League of Nations.

Sir James Frazer is to deliver the Sir Basil Zaharoff lecture for this year.

THE National University of Ireland is about to enter upon its twenty-fifth year and has signalised the approach of this anniversary and "the special signific-

ance of this year, 1932, in the religious and national as well as international life of the Irish people" by issuing a sumptuous "National University Handbook, 1908–1932". This volume, produced at the Sign of the Three Candles in Fleet Street, Dublin, by Colm O'Lochlainn, a graduate of University College, Dublin, deals with the whole of the academic activities of the University, its three constituent colleges at Dublin, Cork, and Galway, and the recognised national ecclesiastical college of St. Patrick, Maynooth, the relationship of the University to secondary schools, and its social and recreative interests. It includes lists of publications, literary and scientific, by the teaching staff and others holding higher degrees of the University. A chapter on applied science records achievements of four of its science graduates distinguished as research workers: Dr. E. J. Butler, director of the Imperial Bureau of Mycology at Kew since 1920; Dr. F. D. Murnaghan, who has held high appointments as a mathematician in the United States; Dr. T. A. McLaughlin, initiator and managing director during the constructive period of the Shannon Power Electrical Scheme; and Dr. J. J. Drumm, an account of whose remarkable traction battery by Prof. A. J. Allmand, published in NATURE of March 12, 1932, is reproduced in the Handbook. The development of work in applied science in the University has been fostered by the liberal system of travelling studentships, to which the Handbook refers as having provided awards far exceeding any similar facilities offered by other universities in the north-west of Europe.

THE University of London has published, in the form of a pamphlet entitled "New Buildings on the Bloomsbury Site" (18 pp. with illustrations and map), its first proposals for the development of this important site of ten acres behind the British Museum. As frontispiece is a photograph of the model prepared by the architect, Mr. Charles Holden, of the proposed University buildings as seen from Russell Square. The model, without detail or fenestration, gives an impression of a vast building, cunningly devised and working up to a great tower, placed centrally on the site and visible from the main approaches to the new buildings. The tower, as the architect explains, will dominate the group and will serve as the main entrance to the buildings—the administrative building to the south and the library and scholastic sections to the north. "The very orderly disposition of the parts", he adds, "and the strong horizontal character of the whole would give to the mass a classical bias which, together with the rhythmical disposition of the window and door openings and other essential features, may be relied upon to present a neighbourly front to the British Museum and to the surrounding buildings, without the necessity of introducing a columnar treatment." The nearest anatomical parallel to the plan is a spine with vertebræ extending from the tower to the northern extremity facing Gordon Square, the administrative block and the Great Hall forming the head and facing Sir John Burnet's northern extension of the British Museum with its classical columns, the Great Hall being on the Russell Square side of this frontage. The height of the tower is not stated, but it would appear to be about 200 ft.—in no sense a skyscraper, but high enough and impressive enough to give character and unity to the architect's design. The pamphlet includes an account of the history of the University, stressing appropriately its difficulties in finding suitable accommodation for its administrative work; and particulars are given of some of the purposes—university and collegiate—for which the new building will be devoted.

## Calendar of Geographical Exploration

### July 3, 1798.—The Zambezi and the Cunene

Lacerda left the Zambezi and travelled northwards between Lakes Nyasa and Bangweolo. He had previously explored the Cunene River, and thought that the upper course of the Zambezi might be connected with the Cunene. If this were so, he hoped that the Portuguese might establish cross-country trade between Mozambique and Benguela. Lacerda died in October 1798, and his party returned to Tete in November 1799. Much new information had been gained, but it was soon forgotten and was not available when Livingstone began his travels.

### July 3, 1826.—The Arctic Coast of Canada, 1825–26

Sir John Franklin reached the head of the Mackenzie delta. There his party divided into two groups, Sir J. Richardson leading a group eastwards and Franklin going west. Richardson traced 863 miles of unexplored coast between the Mackenzie and the Coppermine Rivers, discovering and naming Franklin Bay, Wollaston Land, Dolphin and Union Strait, and Coronation Gulf. Franklin traced the coast westwards from the Mackenzie for 374 miles to Cape Beechey.

### July 4, 1734.—The Siberian Arctic

Pavlov and Muraviev left Archangel to sail for the mouth of the Ob. The expedition formed one of the numerous surveys inaugurated by the Russian Senate, the Admiralty, and the Academy of Sciences in the thirties of the eighteenth century. The impetus towards the geographical survey of Siberia was given by Peter the Great, though the work was not begun until after his death. The boats of the 1734 expedition proved unsatisfactory and a second journey started in 1736, with Malygin in place of Muraviev. Malygin anchored in the sound now named after him; he and his companions mapped the coast of Yalmal and also of Byeli Ostrov. The Ob mouth and the Gulfs of Tas and Gyda were mapped as the result of Ovzyn's voyage (1734–37), while the coast between the Yenisei and the Taimyr Peninsula was explored by Minin in 1738–40.

### July 8, 1497.—Vasco da Gama

Vasco da Gama with four vessels left the Tagus River on a journey which filled in the gap of 800 miles of unknown east African coast between the limit reached by Diaz in his 1487–88 voyage and the part known to the Arabs. After a five-thousand-mile ocean journey, he anchored off the west coast of South Africa near the Cape of Good Hope, where, in their eight days' stay, the Portuguese got into touch with the Hottentots. They put into Mossel Bay, and later passed the pillars set up by Diaz, thus entering unknown waters. Natal was passed on Christmas Day. At the Quilimane River they stayed for twenty-two days, suffering much from the low-lying, marshy nature of the coast. At Mozambique they met Arab dhows and learned from them the nature of their further journey along the east coast. The monsoon favoured them and they reached the Indian coast on May 23. The return journey from India to Africa occupied three months, and so many of the men became ill and died that one ship was abandoned in Mombasa; but after that the conditions were favourable and the first ship reached Lisbon in June 1499. Thus was inaugurated the sea route to India, which so profoundly affected the relations between Europe and Asia. Da Gama made a second voyage to India in 1502, and in 1524 was appointed Viceroy of Portuguese India, but died at Cochin on Dec. 24, 1524.

July 9, 1739.—Cape Chelyushkin

A Russian expedition under Lieut. Laptev left the mouth of the Lena, and reached Cape Thaddeus, 76° 47′ N., on Sept. 2. After wintering at the head of Khatanga Bay, Laptev tried to return to the Lena, but his vessel was nipped in the drift ice off the Olonek River. He and his men with infinite difficulty reached their former winter quarters. Thence Laptev and his second in command, Chelyushkin, made sledge journeys to survey the peninsula, and, in 1742, Chelyushkin reached by land the northerly cape which now bears his name.

## Societies and Academies

### LONDON

Royal Society, June 23.—**R. Whiddington** and **J. E. Taylor**: The photographic action of slow electrons. The photographic action of electrons (60-300 volts) has been experimentally investigated in the case of 'Imperial Duoplex' films. The formula connecting the blackening with the electron current producing it is of the same form as that known to hold in the case of light but with the constants appropriately changed. The 'inertia' of the film is considerably reduced by oiling its surface before exposure, almost certainly due to fluorescence of the oil under electron impact.—**A. Egerton** and **G. S. Callendar**: The saturation pressures of steam (170° to 374° C.). The saturation pressures of steam up to the critical point have been measured by a dynamic method using the apparatus designed by the late Prof. H. L. Callendar for the determination of the total heat of steam. The probable accuracy of the results is 1 in 6000. Previous results by statical methods had agreed satisfactorily to 270° C., but departed considerably from each other above that temperature. The present results lie in the region between the former determinations, and should help in the establishment of a precise knowledge of the thermal properties of steam.

### DUBLIN

Royal Dublin Society, March 22.—**Henry H. Dixon** and **T. A. Bennet-Clark**: Electrical properties of oil-water emulsions with special reference to the structure of the plasma membrane (2). Previous work has been confirmed and extended by the use of modified methods and apparatus. It has now been shown that the electrical behaviour of water-in-oil emulsions agrees with that of cells in the several particulars. The sensitivity of a water-in-oil emulsion is raised with the increase of the sodium/calcium ratio. The change of resistance is associated with the elongation in the path of the current of the minute droplets of the water-phase of the emulsion, and inversion is not necessary even for large changes of resistance. The application of the emulsion-theory of the plasma membrane to the results of permeability experiments is discussed.—**Paul A. Murphy** and **Robert M'Kay**: A comparison of some European and American virus diseases of the potato. In a comparison of a number of European and American virus diseases of the potato undertaken some years ago, it was found that the latent viruses present in American 'healthy' potatoes, as well as in those showing symptoms of various diseases, seriously interfered with the results. The following diseases have been found to correspond on the two continents: leaf-roll, aucuba mosaic, interveinal mosaic, and witch's broom. American leaf-rolling mosaic may have affinities with paracrinkle. No equivalents have been found for six other virus diseases of the potato described in America.

### PARIS

Academy of Sciences, May 17 (vol. 194, pp. 1697-1768).—**H. Vincent** and **L. Velluz**: The cryptotoxic properties of sodium α-oxynaphthoate. Its special action on the diphtheric toxin. Sodium α-oxynaphthoate possesses a selective neutralising action on the diphtheric toxin. The toxin thus neutralised ('cryptotoxin') injected into guinea-pigs gives neither local scar, paralysis, nor general troubles, and gives immunity against the diphtheria toxin.—**André Blondel**: The effect of hysteresis in heating by an oscillating magnetic field.—**Charles Nicolle, J. Laigret, Marcandier,** and **R. Pirot**: The rat, an animal reacting to benign endemic forms of typhus. The long conservation of virus in the rat. It has been found that the rat can act as a reservoir of the virus of some forms of typhus: for typhus of the Old World type, as distinguished from a second type (Toulons, Athens, and elsewhere), the rat carrying the virus shows no sign of infection.—**Charles Nicolle** and **L. Balozet**: An attempt to restore the original activity to rabic virus fixed by intracerebral passages on the dog. The experiments have led to an unexpected result. Instead of increasing the pathogenic power, the inoculations have specialised the virulence for the dog's brain and removed from the virus the power of causing hydrophobia except when placed in the brain.—**E. Mathias, W. J. Bijleveld,** and **Ph. P. Grigg**: The rectilinear diameter of the carbon monoxide molecule. Measurements of the densities of the liquid carbon monoxide and of its saturated vapour at the same temperature for absolute temperatures ranging between 68° and 131°.—**L. Léger** and **T. Bory**: *Eimeria pigra*, a new juxta-epithelial coccidium, parasitic on *Scardinius erythrophtalmus*.—Henry Perrier de la Bathie was elected *correspondant* for the Section of Botany.—**J. Favard**: The distribution of the points where a nearly periodic function takes a given value.—**de Séguier**: Normalisers of substitutions of order 2 of linear, quadratic, Hermitian, and skew groups in a Galois field of odd order.—**Mlle. Mary L. Cartwright**: Certain integral functions of finite order.—**Basile Demtchenko**: The variation of resistance at low velocities under the influence of the compressibility.—**J. Bion** and **P. David**: Daytime weakening of mean and intermediate (wireless) waves propagated over the sea. Sommerfeld's formula $d/\sigma\lambda^2$ ($d$, distance; $\sigma$, conductivity of the ground; $\lambda$, wave-length) has been hitherto examined by varying $\lambda$ and $d$, since the conductivity of the sea is known ($10^{-11}$). For observations made over the sea, with wave-lengths, 700, 215, and 158 metres, and up to a distance of 1050 km., Sommerfeld's formula was found inapplicable: the empirical formula of Austin, on the contrary, gave figures very close to the experiments.—**J. Sambussy**: The part played by the nature of the electrodes in the conductivity of semi-conducting liquids. The current flowing through a column of nitrobenzene depends partly on the material of the electrodes. Some peculiarities in the fall of potential per centimetre were observed with lead, and especially with tantalum electrodes.—**André Lallemand**: The variable paramagnetism of crystallised ferric chloride and the constant paramagnetism of the $Fe_2Cl_6$ molecule in the gaseous state. Constitution of the molecule $Fe_2Cl_6$. In the state of vapour, the two atoms of iron have equal magnetic moments, and hence possess the same valency.—**J. P. Mathieu**: Double salts, complex salts, and circular dichroism.—**René Lucas** and **Marcel Schwob**: The stroboscopic method for the measurement of electrical double refraction.—**Mlle. Ellen Gleditsch** and **Sverre Klemetsen**: The actinum-uranium ratio in an old uraninite-clevite from Aust-Agder (Norway). In this mineral the actinium found was 3·2 per cent of the

uranium. This agrees with the 2·7 per cent previously found for a Norwegian brœggerite and 3·3 per cent for a Cornish pitchblende.—G. Reboul: Radioactive phenomena of the second order and of artificial origin. —Eugène Cornec and Henri Muller: The lowering of eutectic points.—M. Bourguel: The influence of substitutions on the vibration frequency of ethylene compounds. A method of classification of radicals.—R. de Fleury and Benmakrouha: The utilisation of magnesium alloys.—A. Sanfourche and A. Portevin: A particular mode of corrosion of austenitic chrome-nickel steels. This steel, which resists completely the action of cold phosphoric acid, is rapidly corroded if this acid contains hydrochloric acid, even in small proportion. The effects of various treatments of the surface on this corrosion has been studied.—Adrien Karl: Synthetic willemite. The phosphorescence of natural willemite is usually attributed to the presence of impurities (Ni, Fe, Cu). Synthetic willemite, prepared from highly purified materials, showed a violet phosphorescence: the brilliancy of the phosphorescence was increased by the addition of nickel (1 to 2 per thousand) and copper (0·5 to 2 per thousand).—P. Süe: The dehydration of niobic acid.—Maurice Loury: Researches on the diaryl-arylethinyl carbinols. Phenyl-*p*-tolylphenylethinyl carbinol, $C_{22}H_{18}O$, and phenyl-*p*-bromophenylethinyl carbinol, $C_{21}H_{15}.O.Br$.—Georges Lévy: The preparation of a new ethylnaphthol.—F. Loewinson-Lessing: The hortonolite gabbro-diabases of the Siberian trappean formation.—E. Chaput: Geological observations in Asia Minor. The Trias of the Angora region.—Mlle. Elisabeth David: The presence of Lepidocyclines in the Eocene and their relations with the Lepidobitoides.—Jules Amar: The law of renal secretion.—Philippe Fabre and Pierre F. Quesnoy: The comparative efficacity of cuneiform waves of the second kind and of condenser discharges, with equal initial intensity.—Michel Taguet: A new method of studying microbial increase. The method is based on the measurement of the opacity of the culture, by the aid of a photo-electric cell. It is shown that the time-opacity curves for a given organism (*B. coli* in the example given) are superposable. Different organisms give different curves.—Paul Durand: Attempts at curative serotherapy of exanthematic typhus. A suitable quantity of the cephalo-rachidian fluid is removed and replaced by the serum. Temperature charts of twelve cases are given, showing the improvement effected.

ROME

Royal National Academy of the Lincei, Jan. 17.—E. Paternò: (1) Action of oxygen on sodio-cellulose. The action of oxygen on sodio-cellulose at 100° C. yields only β-cellulose (oxycellulose). At the same time the proportion of carbonate present increases appreciably, the carbon dioxide being formed, together with pentosans, from the cellulose according to the equation, $C_6H_{10}O_5 + O_2 = C_5H_8O_4 + CO_2 + H_2O$.—(2) Maturation of sodio-cellulose. This maturation is undoubtedly an oxidation process, the β-cellulose (oxycellulose) formed being transported through the xanthate to the artificial silk, of which it constitutes a normal component.—(3) So-called regenerated cellulose. In the various transformations it undergoes, cellulose can be regarded as regenerated only when the substances it has absorbed are eliminated by washing with water. If the cellulose has been converted into any compound or has passed into solution or been colloidally dispersed, it cannot be regenerated. For example, when cellulose is separated from its zinc chloride or ammoniacal copper solution, from xanthate or viscose, or from sulphuric, hydrochloric, or phosphoric acid solutions, it does not retain its initial properties. Cryoscopic determinations of the molecular weights of colloidal derivatives of cellulose are inconclusive.—E. Bompiani: The contact of two surfaces.—U. Broggi: The development of $\sum_{n=0}^{\infty}\left[b_n\left(\sum_{h=0}^{\infty}a_h x^h\right)^n\right]$ in series of increasing powers of $x$. —G. Sansone: The zeros of the polynomial solutions of the equation $(a_1x+a_0)y''+(b_1x+b_0)y'-nb_1y=0$ (1). —F. Conforto: Considerations on the impulses in isotropic elastic bodies.—N. Moisseiev: The law of the resistance to motion of bodies in a pulverulent medium. —G. Petrucci: Trains of waves emitted at constant time intervals.—G. Todesco: Experimental confirmation of the selective absorption of the Hertzian waves caused by an electronic gas in a magnetic field.—A. Signorini: Certain properties of the medium in ordinary elasto-statics.—L. Infeld: Remarks on the problem of the unitary theory of fields.—Dina Lombardi: Observations on the structure of the nucleus of the larva of *Cricotopus sylvestris* F.

SYDNEY

Linnean Society of New South Wales, March 30.—G. H. Cunningham: The Gasteromycetes of Australasia (14). The family Tulostomataceæ. This family is rearranged to contain the genera *Podaxon*, *Phellorina*, *Chlamydopus*, *Tulostoma*, *Queletia*, and *Battarræa*, all of which, save *Queletia*, have representatives in this biologic region, and is divided into subfamilies and tribes. The only representatives of the family found in New Zealand are confined to the genus *Tulostoma*.—C. P. Alexander: A review of the Tipulidæ of Australia (Diptera) (1). The historical development of the subject and the general facies and distribution of the Australian fauna are discussed. Keys are given for the subfamilies of the Tipulidæ and for the genera of the Tipulinæ, and the Australian species of *Clytocosmus* are reviewed.—F. C. Chisholm: The occurrence of *Atrax venenatus* on the Comboyne plateau. Both male and female examples of *Atrax venenatus* are recorded.—Rev. H. M. R. Rupp: Notes on New South Wales orchids (2). A new genus and species of subterranean orchids, allied to the Western Australian genus *Rhizanthella*, is described from Bullahdelah, and notes are given on other species belonging to *Diuris*, *Pterostylis*, *Dendrobium*, *Prasophyllum*, and *Cymbidium*.

VIENNA

Academy of Sciences, March 10.—Karl Fritsch: Observations on flower-visiting insects in Styria (1912). These observations, made in March–June and September–October in the neighbourhood of Graz and in other parts of Styria, extended to more than sixty plant species, including cultivated exotic species. It is noteworthy that the honey-bee was found to visit an ornithophilous plant, *Agave americana* L.—Karl Przibram: Radio-luminescence and radio-photo-luminescence (3). Examination of the red fluorescence exhibited by many English fluorites after irradiation by radium reveals a band in the red without recognisable lines, this being often confined to certain positions on the crystal. Investigations with synthetic material show that red radio-photoluminescence occurs also with calcium fluoride free from rare earths. With fluorite this phenomenon is, therefore, attributed either to more frequent contamination with heavy metals and only modified by the simultaneous presence of rare earths or to the effect of the rare earths themselves, which do not then emit their characteristic lines.—A. Dadieu, K. W. F. Kohlrausch, and A. Pongratz: Studies on the Raman effect (19). The Raman spectrum of organic substances (isomeric paraffin derivatives). For the vibration spectrum the substituents $CH_3$, $NH_2$, and OH are mechanically

almost equivalent, so that paraffin derivatives containing only these substituents yield vibration spectra of a different type (corresponding with higher molecular symmetry) from those of analogous derivatives with the substituents SH, Cl, Br, etc.—Friedrich Lechner: Studies on the Raman effect (20). Theory of the valency force system with three mass points.

## Forthcoming Events

*MONDAY*, JULY 4

ROYAL INSTITUTION (General Meeting at the Institution, 21 Albemarle Street, London, W.1), at 5 P.M.

*FRIDAY*, JULY 8

PHYSICAL SOCIETY OF LONDON (Special General Meeting at the Imperial College of Science and Technology, South Kensington, S.W.7), at 5 P.M.

*SATURDAY*, JULY 9

SOCIETY OF CHEMICAL INDUSTRY—South Wales Section (Special Joint Meeting with the South Wales Section of the Institute of Chemistry at the laboratories of the Cardiff Gas, Light and Coke Company, Bute Terrace, Cardiff), at 3 P.M.

## Official Publications Received

BRITISH

The Quarterly Journal of the Geological Society of London. Vol. 88, Part 2, No. 350. Pp. 111-311. (London: Longmans, Green and Co., Ltd.) 7*s.* 6*d.*

Report of the Haffkine Institute for the Year 1930. By Major L. A. P. Anderson. Pp. 76. (Bombay: Government Printing and Stationery Office.) 6 annas; 8*d.*

Journal of the Chemical Society. May. Pp. v+1333-1641+x. (London: Chemical Society.)

Armstrong College, Newcastle-upon-Tyne: Standing Committee for Research. Report, Session 1930-1931. Pp. 36. (Newcastle-upon-Tyne.)

The Scientific Proceedings of the Royal Dublin Society. Vol. 20, N.S., Nos. 13-20: On Alginic Acid, its Mode of Occurrence and its Constitution, by Dr. Thomas Dillon and Annie McGuinness; The Performance of a Reservoir subjected to Flood, by H. H. Jeffcott; Cytological Studies of Potato Plants affected with certain Virus Diseases, by Dr. Phyllis Clinch; The Effect of an Insufficient Supply of Vitamin D on the Growth of the Skeleton and Internal Organs of Chickens, by E. J. Sheehy and Miss K. Sheil; Report on the Recent Bog-Flow at Glencullin, Co. Mayo, by A. D. Delap, A. Farrington, R. Lloyd Praeger and Louis B. Smyth; A Critical Review of some Recent Work on the Occurrence of Virus Complexes in the Potato, by Dr. Paul A. Murphy; Electrical Properties of Oil-Water Emulsions, with Special Reference to the Structure of the Plasmatic Membrane, II, by Prof. Herbert H. Dixon and Dr. T. A. Bennet-Clark; The Compound Nature of Crinkle, and its Production by means of a Mixture of Viruses, by Dr. Paul A. Murphy and Robert M'Kay. Pp. 129-247+plates 4-12. (Dublin: Hodges, Figgis and Co.; London: Williams and Norgate, Ltd.) 12*s.*

Imperial Bureau of Plant Genetics: Herbage Plants. Bulletin No. 7: Further Contributions on the Technique employed in the Breeding of Herbage and Forage Plants. Pp. 33+4 plates. (Aberystwyth: Agricultural Buildings.) 2*s.*

The Film in National Life: being the Report of an Enquiry conducted by the Commission on Educational and Cultural Films into the Service which the Cinematograph may render to Education and Social Progress. Pp. xii+204. (London: George Allen and Unwin, Ltd.)

Memoirs of the Royal Meteorological Society. Title-Page, Contents, Summaries and Discussion, Vol. 2, Memoirs Nos. 11-20, 1927-1928. Pp. iv+173-185. (London: Edward Stanford, Ltd.) 2*s.* 6*d.*

Air Ministry: Aeronautical Research Committee: Reports and Memoranda. No. 1449 (S. 100): Anchors for use on Flying Boats. By L. P. Coombes and the Experimental Staff of the Marine Aircraft Experimental Establishment, Felixstowe. Pp. 14+10 plates. 1*s.* 3*d.* net. No. 1421 (T. 3053, 3178): Spinning of a Single Seater Fighter with Deepened Body and Raised Tailplane. Part 1: Model Experiments, by H. B. Irving and A. S. Batson; Part 2: Full Scale Spinning Tests, by A. V. Stephens. Pp. 16+20 plates. 1*s.* 3*d.* net. No. 1443 (T. 3164 and "a"): Wind Tunnel Tests on Aileron Loads. By F. B. Bradfield, G. F. Midwood and F. R. C. Hounsfield. Pp. 20+25 plates. 1*s.* 3*d.* net. (London: H.M. Stationery Office.)

Memoirs and Proceedings of the Manchester Literary and Philosophical Society. Vol. 75, 1930-31. Pp. iv+117+lxix. (Manchester.) 10*s.*

Proceedings of the Royal Society. Series A, Vol. 136, No. A830, June 1. Pp. 465-766. (London: Harrison and Sons, Ltd.) 12*s.* 6*d.*

Transactions of the Optical Society. Vol. 33, 1931-32. No. 2. Pp. ii+37-72. (London: Optical Society.) 12*s.*

Royal Observatory, Hong Kong. The Climate of Hong Kong, 1884-1929. By T. F. Claxton. (Appendix to Hong Kong Observations, 1931.) Pp. 38+31 plates. (Hong Kong.)

Commonwealth of Australia. Fifth Annual Report of the Council for Scientific and Industrial Research for the Year ended 30th June 1931. Pp. 54. (Canberra: H. J. Green.)

The Economic Botany of Cacao: a Critical Survey of the Literature to the end of 1930. By Prof. E. E. Cheesman. Pp. 16. (Trinidad: Government Printing Office.) 1*s.*

Report of the Astronomer Royal to the Board of Visitors of the Royal Observatory, Greenwich, read at the Annual Visitation of the Royal Observatory, 1932 June 4. Pp. 19. (Greenwich.)

Commonwealth Bureau of Census and Statistics, Canberra. Official Year Book of the Commonwealth of Australia. No. 24, 1931. Compiled by Chas. H. Wickens. Pp. xxxii+808. (Canberra: H. J. Green.) 5*s.*

Proceedings of the Royal Irish Academy. Vol. 40, Section B, No. 15: The Fens of North Armagh. By J. M. White. Pp. 233-283+plate 6. (Dublin: Hodges, Figgis and Co.; London: Williams and Norgate, Ltd.) 2*s.* 6*d.*

FOREIGN

Proceedings of the Academy of Natural Sciences of Philadelphia, Vol. 84. West Mexican and Central American Mollusks collected by H. N. Lowe, 1929-31. By H. A. Pilsbry and H. N. Lowe. Pp. 33-144+17 plates. A Collection of Birds from Southwestern Africa. By Rodolphe Meyer de Schaunsee. Pp. 145-202+plates 18-26. The Name of *Lophoceros bradfieldi* from Bechuanaland and Rhodesia. By Rodolphe Meyer de Schaunsee. P. 203. (Philadelphia.)

Smithsonian Miscellaneous Collections. Vol. 87, No. 8: Graphic Correlation of Radiation and Biological Data. By F. S. Brackett. (Roebling Fund.) (Publication 3170.) Pp. 8. (Washington, D.C.: Smithsonian Institution.)

Proceedings of the Academy of Natural Sciences of Philadelphia. Vol. 83, 1931. Pp. iii+487+41 plates. (Philadelphia.) 6.25 dollars.

Conseil Permanent International pour l'Exploration de la Mer. Faune ichthyologique de l'Atlantique nord. Publiée sous la direction de Prof. Joubin. No. 9. 24 planches. 4.00 kr. No. 10. 24 planches. 4.00 kr. (Copenhague: Andr. Fred. Høst et fils.)

Proceedings of the Imperial Academy. Vol. 8, No. 4, April. Pp. vii-viii+113-141. (Tokyo.)

Statens Meteorologisk-Hydrografiska Anstalt. Årsbok, 11, 1929. iii. Vattenståndet vid Rikets kuster. Pp. 21. 2.00 kr. Årsbok, 11, 1929. iv. Meteorologiska iakttagelser i Sverige, Band 71. Pp. x+179. 7.00 kr. Årsbok, 12, 1930. v. Hydrografiska mätningar i Sverige. Pp. 40. 3.00 kr. Årsbok, 13, 1931. i. Månadsöversikt över väderlek och vattentillgång jämte anstaltens årsberättelse. Pp. 94. 2.50 kr. (Stockholm.)

Collection des travaux chimiques de Tchécoslovaquie. Rédigée et publiée par E. Votoček et J. Heyrovský. Année 4, No. 5, Mai. Pp. 193-238. (Prague: Regia Societas Scientiarum Bohemica.)

Ministry of Public Works, Egypt: Physical Department. Meteorological Report for the Year 1926. Pp. xi+156. (Cairo: Government Press.) 40 P.T.

League of Nations' Intellectual Co-operation Organisation. Information Bulletin, Vol. 1, No. 1, April. Pp. 32. (Paris.) 1*s.*

Smithsonian Miscellaneous Collections. Vol. 87, No. 9: Periodicity in Solar Variation. (Roebling Fund.) By C. G. Abbot and Gladys T. Bond. (Publication 3172.) Pp. ii+14+2 plates. (Washington, D.C.: Smithsonian Institution.)

Journal of the Faculty of Agriculture, Hokkaido Imperial University, Vol. 33, Part 1: Studies on the Morphology and Ecology of the Rice Leaf-Beetle, *Lema oryzae* Kuwayama, with Special Reference to the Taxonomic Aspects. By Satoru Kuwayama. Pp. 132+4 plates. (Tokyo: Maruzen Co., Ltd).

Publications of the Allegheny Observatory of the University of Pittsburgh. Vol. 9. Pp. iii+213. (Pittsburgh, Pa.)

Science Reports of the Tokyo Bunrika Daigaku, Section B. No. 1: Über die Farbbarkeit der fixierten Zellstrukturen. Von Gihei Yamaha. Pp. 21. 25 sen. No. 2: Zur Kenntnis der Alginsaure, I. Von Tomo-o Miwa. Pp. 23-37. 23 sen. No. 3: On the Sexual Reproduction of *Prasiola japonica* Yataba. By Yoshitada Yabe. Pp. 39-40+1 plate. 10 sen. (Tokyo: Maruzen Co., Ltd.)

National Research Council of Japan. Report No. 8-9, April 1928-March 1930. Pp. iii+229-350. (Tokyo.)

Proceedings of the Delaware County Institute of Science. Vol. 9, No. 4. Pp. 153-204. (Media, Pa.)

Peking Natural History Bulletin. Vol. 6, Part 4: Chinese Materia Medica. vi: Avian Drugs. By Bernard E. Read. Pp. 112. (Peiping: The French Book Store.) 1.50 dollars.

The Science Reports of the National Tsing Hua University. Vol. 1, No. 4, May. Pp. 129-157. (Peiping.)

Egyptian Government: Ministry of Public Works. Annual Report for the Year 1927-1928. Part 1. Pp. vi+166. (Cairo: Government Press.) 20 P.T.

Publications of the Manila Observatory. Vol. 3, Nos. 1-10: Oceanographic Papers. Report of the Subcommittee on Physical and Chemical Oceanography of the Philippine Islands to the International Committee on Oceanography of the Pacific Science Congress. By Rev. Miguel Selga, Rev. Wm. C. Repetti, Wallace Adams. Pp. 210. (Manila: Bureau of Printing.)

Report of the National Research Council for the Year July 1, 1930-June 30, 1931. Pp. iv+92. (Washington, D.C.: Government Printing Office.)

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