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CONTENTS.

	PAGE
Health in the Tropics	593
Tropical Timbers. By A. L. Howard	595
Foundations of the Theory of Optical Instruments. By Dr. L. C. Martin	597
Medieval Science. By E. J. Holmyard	599
Our Bookshelf	600
Letters to the Editor :	
Permo-Carboniferous Glaciation and the Wegener Hypothesis.—Prof. A. P. Coleman, F.R.S.; Prof. J. W. Gregory, F.R.S.	602
International Co-operation in Phenological Research.—J. Edmund Clark	602
Depth-recording with Plankton-nets.—F. S. Russell	603
Spectroscopic Evidence of J-Transformation of X-rays.—Dr. S. R. Khastgir and W. H. Watson	604
Acidity produced in Salt Solutions by Sphagnum.—Dr. Macgregor Skene and Gladys L. Stuart	605
Three Cases of Abnormal Anterior Abdominal Veins in the Frog.—Dr. Nellie B. Eales	606
The Life-History of Amœba.—Dr. Monica Taylor	606
Total Intensity of Scattered X-radiation.—O. K. DeFoe and W. W. Nipper	607
The Auroral Green Line.—Prof. J. C. McLennan, F.R.S.	607
The Mortality of Plaice.—Dr. William Wallace	607
Robert Browning as an Exponent of Research.—Prof. W. R. Whitney	607
Physiology and "Vital Force." By Prof. Fraser Harris	608
The German Museum of Science and Technology	611
Obituary :—	
Dr. Carl Ulrich. By Dr. Robert W. Lawson	612
Current Topics and Events	613
Our Astronomical Column	616
Research Items	617
The International Geographical Congress	620
The Preservation of Food	621
Navigation and Fishing on the Ganges. By Dr. Henry Balfour, F.R.S.	622
Synthetic Methyl Alcohol	622
University and Educational Intelligence	623
Early Science at Oxford	624
Societies and Academies	624
Official Publications Received	628
Diary of Societies	628
Recent Scientific and Technical Books	Supp. v

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Health in the Tropics.

THE medical conference which was held in the West Indies during last summer was probably unique in the history of medical science in that it was organised by a purely commercial company. The delegates, amongst whom were many distinguished men, were the guests of the United Fruit Company, and it is a remarkable fact that a wealthy commercial undertaking, having its offices in New York, should have a Medical Department, and that its directors should accept the advice of the general manager of that Department to issue invitations to laboratory workers and clinicians belonging to many nations to attend, as the guests of the Company, a conference to be held in a colony of the British Empire situate in the West Indies.

The particular conference was specially charged with showing to the guests what the Company is doing to maintain the health of its employees in tropical America and with obtaining, by discussion, suggestions for still further improvement of the conditions of life. The lesson is of supreme scientific importance, and is one which should be learned by all those, whether of British or any other nationality, who are engaged in commercial enterprise in tropical lands. The United Fruit Company has realised that sanitation pays and has acted accordingly. It has had the will to do the things that are necessary and has recognised the fact that what cannot be afforded is to leave them undone.

Scientific investigation has revealed the method of spread of practically all the diseases which are liable to afflict the dweller in the tropics, and the means of controlling these diseases are well known. Yet such is the scepticism or lethargy of those in command that in many cases they refuse to recognise the fact that sanitation is a commercial proposition repaying all the trouble taken in hard cash, which is the ultimate aim of all business undertakings. It is to be hoped that the demonstration given by the United Fruit Company will be thoroughly appreciated and, what is more important, acted upon.

One of the principal topics of discussion at the conference was the possibility of the white man becoming an inhabitant of the tropics. It is often assumed that the wonderful advances in tropical medicine will make the tropics a suitable home for the white man, and that in days to come the tropics will displace the temperate zones as the centres of activities of the world. This appears to be the view of the majority of those present at the conference. They believe that the attainment of normal longevity is not difficult provided that industrious habits are maintained, restraint as regards indulgence in intoxicating liquors is practised, and venereal disease and parasitic infections—especially hookworm and malaria—are avoided. Sir

James Fowler[1] is convinced that even if these risks are met, over and above them all there is something which cannot be avoided. The crux of the whole problem appears to him to be the children, and he claims that if the Englishman is to become as much at home in the tropics as he is in England, he must be able to rear his family there. If he cannot do this he will certainly remain, as he now is, only a migrant.

Whichever of these two opposed views is correct, it still remains a fact that, by attending to sanitation and preventive medicine, a great deal can be done to diminish the sick rate amongst white men in the tropics. Sir James Fowler points out that as regards the general sanitation of Jamaica, the municipal authorities stand condemned on every count, and should be replaced by an administration armed with powers adequate to the cleansing of such an Augean stable. In contrast, the farms of the United Fruit Company are described as sanitary oases in an unsanitary desert. The Company owns the only possible hotels in Jamaica. When it takes over an estate, its first procedure is to build a hospital, to erect mosquito-proof workmen's dwellings and farm buildings, to instal all necessary sanitary appliances and to establish a satisfactory water supply, so that everything required to protect the health of employees is ready on their arrival.

The report of the Medical Department of the Company for 1923 consists of 180 pages, and shows that there is a staff of 50 doctors, 43 registered nurses, and 442 workmen. Nearly every well-known university and medical college in the United States is represented among the personnel. In addition to the establishment of a highly equipped medical organisation, the Company has built churches and schools, has erected club-houses and amusement halls, and has provided athletic grounds, all of which contribute very largely to the creation of an atmosphere of content, without which the mental depression noted above creeps in and so lowers vitality that inevitable sickness results.

One of the diseases which requires constant vigilance in tropical America is yellow fever. Thanks to the investigations of the American Commission in 1900, it is known that the disease is carried by the black and white mosquito *Stegomyia fasciata*. Noguchi has isolated from cases of the disease a spirochæte which he has named *Leptospira icteroides*. It has been recovered from cases in several distinct outbreaks of the disease, but, though Noguchi claims that in animals the organism reproduces the disease, there are some who doubt whether it is really the actual cause of yellow fever. Agramonte, one of the original members of the 1900 Commission, was present at the conference. He claimed that the only conclusive proof would be the reproduction of yellow fever in human beings by inoculation of a pure culture of the organism. He threw down the challenge to Noguchi and offered to produce the necessary volunteers. If the organism should prove not to be the cause of yellow fever, then there would be little argument for employing the serum and vaccine which are produced from it in the treatment of the disease.

The subject of yellow fever leads to Panama, for, as is well known, it was only as a result of the control of mosquitoes, the carriers of malaria and yellow fever, as organised by General Gorgas, that the construction of the canal became a possibility. Here again is the same object-lesson—strict attention to the protection of employees from tropical diseases alone rendered possible this great achievement. The work accomplished, the question arose as to whether there was justification for the enormous expenditure of money which the maintenance of the sanitary condition involved. In June 1921 there arrived on the Isthmus a special Panama Canal Commission appointed by the Secretary of War. It consisted of a Brigadier-General of the Army, a Captain of the Navy, and two business men. They recommended that the amounts expended for sanitation in the Canal Zone be greatly reduced, and if, as a result, the sick and death rate from malaria rises above the average in twenty of the largest cities of the United States, the sanitary precautions be increased. This recommendation was not accepted by the Secretary of War, but nevertheless attempts were made to reduce expenditure. The reductions chiefly concerned Silver City, and the result was that in 1922 there was more than five and one-half times the usual incidence of malaria.

Another danger arises from the settlers, those discharged labourers who have been given a portion of land to cultivate. The result of this policy, again, has been a large increase in the number of cases of malaria among non-employees who are widely scattered over the available parts of the Zone. It is estimated that 650 families are now living on the land in this way. This population is difficult to control, and is liable to form a reservoir of malarial infection which will become a danger to those whose work requires them to be exposed at night in unsanitated areas. On the other hand, it is claimed that these settlers bring advantages in the increase and cheapening of food. It is evident that in such an area as the Panama Canal Zone and in the thousands of similar areas in all parts of the tropical world, the health of employees can only be maintained by the strictest vigilance, and the necessary expenditure has been shown by the United Fruit Company to be an investment which will bear the closest scrutiny.

[1] "An Impression of Jamaica and the Panama Canal Zone." By Sir James K. Fowler. Pp. 60. (London: Eyre and Spottiswoode, Ltd., 1924.) 2s.

Tropical Timbers.

Timbers of Tropical America. By Prof. Samuel J. Record and Clayton D. Mell. (Published on the Foundation established in memory of Amasa Stone Mather of the Class of 1907, Yale College.) Pp. xviii+610+50 plates. (New York: Yale University Press; London: Oxford University Press, 1924.) 10 dollars.

NEARLY the whole of this work is made up of descriptions of the trees and woods of tropical America by Prof. Record, professor of forest products, Yale University, and the remainder, on tropical American countries and their forests, is by Mr. Mell, tropical forester. There are fifty pictures of forests, forest lands, individual trees, timber, and timber sections, and a very full description of seventy-five different families of trees, with full particulars of an innumerable number of different timbers. The whole forms a complete and up-to-date standard work, and is a very welcome addition to the somewhat bare library of books on the subject of the forests and timbers of the world.

Hitherto very little has been written either in regard to these forests or their timbers. This especially applies to the timbers of Brazil, about which there has been the utmost confusion, and in regard to Guiana the same can be said, excepting for Stone and Freeman's "Timbers of British Guiana."

The introduction of Mr. Mell's work is particularly valuable, because he has been over a large part of this vast country and gained his information first-hand; while the author has made a very thorough and patient study of the woods under the most favourable conditions. These vast tracts of forest and the magnificent timbers which they contain, and the rapidity of the growth, give the reader some consolation when he reflects upon the enormous demand which the world at present exacts for supplies from more accessible sources; so that while half of the world is deploring the want of transport facilities to enable them to destroy forests, the other half can rejoice that such difficulties are wellnigh insuperable.

Bernard Palissy wrote in the sixteenth century:

"I am quite astonished at the ignorance of man, for it appears that to-day he only studies how best to destroy the beautiful forests that his predecessors guarded so sacredly . . . for after all the trees have been cut down it will be necessary for all the arts to cease. . . . I have often wished to make a list of the arts which would cease if there were no longer any wood, but when I had written down a large number of them, I found that there would be no end to the enumeration, and, after due consideration, I came to the conclusion that there was not even one trade which could be carried on without wood."

The "ignorance of man" has caused him also to fail to make sufficient, or almost any kind of, provision for the future. Paul Charpentier in "Timber" wrote:

"To-day the hand of man has used, in such a manner and for so long, the treasures of Nature without foresight that the greatest preoccupation of cultivators of forests—the question which ought to attract the attention of Governments most—is the replanting with trees of the land once occupied by forest."

There is no sufficient practice, if any, of re-afforestation taking place in America. In Africa hundreds of thousands of giant trees have been cut down, and it is doubtful whether any scheme of re-afforestation in these dense tropical forests could be practised even if it was attempted; and in India and Burma, where scientific forestry has been practised for fifty-six years, no proper consideration has been given as to the planting of the most valuable sorts. The planting of mahogany has, for example, scarcely been seriously considered; yet in the Botanical Gardens of Calcutta there were three trees (*Swietenia mahogani*), one of which was felled for improvements in the gardens, and proved to be of the most beautiful quality, equal to the best in Honduras; two others which were felled especially to be shown at the British Empire Exhibition, one of which had apparently required only 113 years to produce a diameter at the butt of 6 ft. 6 in., weighing 10½ tons, and containing 4007 ft. of board measure; and the other in 89 years having produced 4 ft. diameter at the butt, 4½ tons in weight, and 1575 ft. of board measure. The quality of the wood in these two trees was excellent.

Strange indeed it is that forest officers, only excepting in regard to teak in Burma and oak in Germany and Slavonia, have paid so little attention to the matter of providing for the future those trees which have been found to be so valuable in the past. The great French Minister Colbert said: "France will perish for want of wood." We should take his warning to heart, for, turning to Great Britain, in the past our reserves of forests have stood us in good stead, but our ash has gone, our oak is going, and the plentiful supplies of all kinds which have come to our rescue in times of national stress on more than one occasion will not be found in the future, unless we recognise the necessity of providing for our possible needs.

It is true that the Government has organised a Forest Department which is doing good work; and so far as it goes, this is something to the good, but it is quite an inadequate measure. Even if this Department had far greater resources and power, government departments are always cumbrous and of necessity work slowly on somewhat extravagant lines.

In the Slavonian country, whether the forests belong to government, to municipalities, or to private persons,

all alike have to conform to a regular rule; that is, for every tree that is allowed to be cut, a certain number have either to be planted, or if natural regeneration is taking place, protected and preserved; so that every year the area of forest land is not only maintained but also actually increased.

We have yet to find out the disaster which we have suffered, and are still suffering, by the loss of our wealthy landed gentry; it will be felt in the future in agriculture, but in timber the loss will be far greater. When at last all the great estates have been parcelled out, all the timber that can be sold will be cut to meet the levies of high taxation, and the real source from which our forest reserves have been accumulated will disappear. One of these great landowners not long since showed a vista of land from his house stretching for miles which in his grandfather's time was covered with trees of considerable value, but now the trees have altogether gone.

Paul Charpentier said that the cultivation of forests was a question which ought to attract the attention of governments most; if government were to institute a well-devised scheme by which every owner of land, instead of being taxed because of plantations, was given a remission of taxation on that account, much would be accomplished. The owner of land, whoever he may be, has a natural love for and desire to plant, but he is stopped from doing it because he knows he would be pounced upon by the revenue authorities. An excellent system is practised in Burma, under which the government lets out sections of land to growers of rice or "paddy"; these parcels of land are let on an entirely nominal rental, and the tenant has to plant his trees under the direction of the forest officer. After planting, the trees have to be tended and kept in good order, and at the end of a few years the ground is given up to the government and becomes forest, while the tenant moves on to another section.

The ignorance referred to by Bernard Palissy is largely due to the indifference shown in our educational work to the necessity for including forest subjects and a knowledge of trees as a study of first importance. It would be interesting to find what proportion of our population could identify even our own common trees. A greater knowledge would not only become of great national value, but would also raise the standard of the people's sense of the beauty of Nature.

This also suggests another phase, which is the extravagance of the British public in their use of timber. Free imports and a fairly high rate of money exchange have made it possible for us to be extravagant in this respect, so that timber which is highly valued in France, Germany, etc., and used with great regard to economy for all kinds of purposes, is here considered unsuitable, and is used either for estate purposes or burned.

An Englishman visiting the timber yards on the Continent to-day is amazed to see the kind of material which is being used for decorative woodwork. In Great Britain, thousands of tons of highly selected timber of foreign origin are used in works where a much inferior quality would equally well serve the purpose; and so, while we fail to realise the importance of storing up a future supply for ourselves by wisely devised schemes of re-afforestation, we are also spendthrifts in regard to those supplies which we get from overseas. It is consoling at any rate that in the country about which Prof. Record gives us so much information there is a large reserve.

The book is arranged in order of families, with a summary following each kind, giving information for identification and comparison. The method is a good one for the student, but not altogether attractive to any who are not enthusiasts. It is a matter of regret that the admirable plan of showing forest areas by means of maps, adopted by Zon and Sparhawk in "Forest Resources of the World," has not been used here.

A bold pronouncement is made as to the source of real mahogany, when the author says: "Swietenia with five known species is the only source of true mahogany" (p. 348). He apparently overlooks Mr. Herbert Stone's remark in "Timbers of Commerce," p. 32, where a different conclusion is reached, and one which the reviewer endorses.

The question of nomenclature of timbers must always remain an exceedingly difficult and complex one. A certain latitude must be observed, and the use of the name "mahogany" is a case where a broad view should be taken. There are other woods where the case is quite different. It would be absurd not to call African mahogany "mahogany," yet according to the author's pronouncement it is not mahogany at all. The same would not apply to a wood like teak, because there is only one teak—*Tectona grandis*—and no other kind of timber from any part of the world possesses its qualities or its real appearance, so that to add the name "teak" to any other wood is wellnigh fraudulent.

The name "mahogany" has, however, throughout many years become a general term, and it is very doubtful if what was first known as mahogany was *only* the produce of Swietenia. The great similarity of so many other species is so remarkable that they can justly claim the right to the name.

The author attributes the slowness of the development of the general use of mahogany to the fact that the material was considered too difficult to work, but it seems more likely that the real cause was the pre-

judice which is invariably experienced in the introduction of any new timber, as well as the tax originally imposed.

Mahogany was first used by Cortez in 1521, by Sir Walter Raleigh in 1597, by Capt. Dampier in 1681, and first used in England for cabinet-making in 1754; yet we find that the greatest possible efforts were still being made in 1846 to persuade people to make more general use of this magnificent wood.

In a work which covers such a vast field it is not surprising that some debatable points should arise; for example, the author quotes a writer who states that East Indian satin wood is frequently confused with Prima Vera mahogany (p. 318), but even the amateur should not make this mistake, as there is a marked difference in texture and figure. It is stated also that East Indian satin wood is paler in colour than that of Porto Rico and Santo Domingo, but while the variation in colour generally is similar, much darker wood can be found from East India than from West India. Again, it is probable that the scents produced when working West Indian, East Indian, and Concha satin wood are all alike; certainly the scent of all three when burning is similar, although perhaps this is not so pronounced in the case of the last two named, which provides a rather interesting subject for the botanist. It is doubtful also whether the author would be able to sustain the description of Concha satin wood (p. 318) as being an inferior grade of wood. The gum streaks which it contains have militated against its popularity in America, but in all other markets it is most favourably received, and in individual cases has actually been preferred, generally, size for size, and value for value, and has realised fully as much as the regular satin wood.

There has always been the utmost confusion in regard to Brazilian woods, largely on account of the repetition of names, and because similar names have been applied to entirely different species. For example, sixteen kinds of Canella are mentioned on p. 179, including *Canella batalha*, *limao*, and *preta*. These all belong to the *Nectandra sp.*, but there is an entirely different species also called Canella, that is, the Wild Cinnamon, the source of which is *Canella winterana*. There is no doubt that timbers of both species have been shipped on account of the name, regardless of which was required, to the utmost dissatisfaction of those who received them.

Prof. Record's specimen of *Pithecolobium vinhatico* is reported to weigh 37 lb. (p. 211). A brother of the well-known Mr. J. S. Gamble, who was many years in Brazil and got together a very exhaustive collection of Brazilian timbers, together with a host of information, produced a specimen of Amarello which he names as from the same source, but which weighs 49 lb. The reviewer identifies this wood as being the equivalent to the *Adenanthera Pavonina* of the Andaman Islands. Mr. Gamble also had a specimen which the reviewer named Vinhatico, but which Gamble names as *Symplocos sp.* Again, Gamble's specimen of *Angelim amargosa* weighs 49 lb., and is attributed to Anthelumthica. There is a specimen in Gamble's collection of *Arariba Rosa* to which the same source is given, weighing 40 lb. against Prof. Record's 55 lb. There is a specimen of *Arœira do Sertao*, which was traced as being *Astronium urundueva*, and possibly Myrocrodon, weighing 69 lb.

Those who have never attempted the task would be astonished at the immense amount of time and work which is required to unravel the maze surrounding the identification of timbers and to trace them to their original source. This book is full of new information, so that the authors are to be congratulated upon the painstaking efforts they have made in bringing all this material together. Every one interested in the subject of forestry and timber will be anxious to possess it. A. L. HOWARD.

Foundations of the Theory of Optical Instruments.

Grundzüge der Theorie der optischen Instrumente nach Abbe. Von Siegfried Czapski und Otto Eppenstein. Dritte Auflage. Bearbeitet von den wissenschaftlichen Mitarbeitern der Zeissischen Werkstätte: H. Boegehold, O. Eppenstein, H. Erfle, A. König, M. v. Rohr. Herausgegeben von H. Erfle und H. Boegehold. Pp. xx+747. (Leipzig: J. A. Barth, 1924.) 30 gold marks.

A THIRD and greatly enlarged edition of this work, the original material of which was written by Dr. Siegfried Czapski for Winklemann's "Handbuch der Physik," has now been completed by several of the principal scientific workers in the firm of Zeiss. The death of Ernst Abbe in 1905, followed by that of Czapski two years later, removed the original mastermind and also one who performed a great service in making Abbe's work and methods known to others.

Although Abbe's theories are well known to-day, and the parts of the present volume which deal with them contain little that is unknown to English readers, the appearance of names like that of Prof. Moritz von Rohr amongst the collaborators is a sufficient guarantee that the new sections will not be lacking in originality. A case in point is the generalised treatment of the space presentation possible through different types of perspective and stereoscopic reconstruction in the use of binocular optical instruments.

The volume contains some twenty-one chapters, mostly of considerable length; some are highly mathematical and "condensed," while others are of a more descriptive character, in which the discussion is apt to be a little out of proportion with the general character of the work. The geometrical theory of instruments occupies the first ten chapters, a great deal of the treatment being similar to that which is now available in English through Mr. Kanthack's translation of the well-known book "The Formation of Images in Optical Instruments" (a symposium edited by Prof. von Rohr). The present work, however, has chapters on such subjects as diffraction phenomena and their relation to optical instruments, and the formation of images by non-spherical surfaces.

The last eleven chapters contain general discussions and descriptions of such instruments as photographic lenses, hand magnifiers, microscopes, projection apparatus, and telescopes. The important subject of practical optical measurements (curvatures, focal lengths, and the like) is unfortunately crowded into one chapter at the end, which will probably be difficult reading to any one who has not the knowledge necessary to supplement its brevity. The aim of the authors has apparently been not only to furnish a presentation of the theory and facts, but also to include, wherever possible, references to all known published work bearing on the subject in hand, together with some comment on the results described in the papers thus cited. The effect is naturally a very considerable expansion of the discussion; the book will occupy for optics almost the place that Kayser's famous "Handbook" has filled for spectroscopy. Hence it is bound to prove, for this reason alone, a most useful work of reference for a person already well acquainted with the subject generally.

On the other hand, the work should be avoided by the beginner. It is certainly no royal road to the design and computing of optical systems, for the trouble in work of that kind is to know "where to begin." It is to be feared that the average student would be in the same difficulty after reading its seven hundred pages, even if he found time to do so. He would also have some difficulty in deciding which were the parts of real practical importance and which were of merely mathematical interest. We are told at one place (p. 242) that if several bendings of a lens are taken and the spherical aberration is plotted against the curvature of the front surface, a parabolic law is found. A serious student should put the book down at this point and work out the formula numerically to obtain data to plot the curve. Unless this kind of thing is done, these formulæ are nothing but dancing figures.

No adequate attention is paid to the subject of the tolerances for aberrations. It avails little to be able to calculate the magnitude of a defect unless one has some idea as to what amount is allowable in relation to the particular circumstances. The truth is that formulæ expressing aberrations in terms of ray intercepts are quite unsuitable for the discussion of tolerances except in cases where these are comparatively large. The matter can only be dealt with satisfactorily, as Prof. Conrady has always maintained, by considerations of optical path.

It is, however, encouraging to find that the applications of the diffraction theory to the elucidation of the phenomena in the neighbourhood of a focus with or without aberration are beginning to receive the attention they deserve, and the necessary warnings are given on p. 238, where transverse aberration and diffusion circles are discussed. The diffraction theory of spherical and chromatic aberrations receives a separate chapter, but although the recent theoretical and numerical work carried out by Conrady and others in this connexion is mentioned, the results are not included. It would now appear that the statement on p. 313 regarding the effect of spherical aberration is incorrect. It is there maintained that increasing aberration will always diminish the resolving power of a lens system for an object like a double star. On the contrary, it has now been shown that a smaller central image disc may be produced slightly away from the ordinary focus under some degrees of spherical aberration; this will actually give increased resolution in spite of surrounding "haze." It need scarcely be said that this is a practical point of the greatest significance, for it shows that high resolving power is not necessarily a test of the best optical correction.

The equation $nhu = n'h'u'$ is now styled the Huygens Helmholtz equation! Has ever an equation received so many names? If the claims of R. Smith and Lagrange are thus passed over, it might be shorter to call it the Huygens equation and end the matter finally in this way. While speaking of names it might be pointed out that Mr. T. Smith, of the National Physical Laboratory, Teddington, the author of the papers to which references are given, should not be confused with Prof. T. T. Smith.

The lapse of a few more years will make the inclusion of full references an almost impossible task. Has not the time arrived when authors should have the courage to set forth clearly what they consider to be the essential parts of a subject without including matter which, for the majority of users of their books, has little more than mere theoretical interest?

L. C. MARTIN.

Medieval Science.

Studies in the History of Mediaeval Science. By Prof. C. H. Haskins. Pp. xiv+411. (Cambridge, Mass.: Harvard University Press; London: Oxford University Press, 1924.) 28*s.* net.

THERE are few words which can evoke such a wealth and variety of reactions as "medieval." To the average man, perhaps, it recalls glimpses of illuminated missals caught in a brief walk through the British Museum; the poet will murmur *Donne ch' avete intelletto d' amore*, while the philosopher will dream dreams of the schoolmen and their interminable arguments. In the phrase "medieval science," however, many men of science of to-day will see nothing but a contradiction in terms, for it is a widespread idea that the Middle Ages stood for the very antithesis of all that is implied by the method and outlook of science as we understand it. Yet it requires but a little patience and insight to realise that, even in those remote and difficult times, the true spirit of science was awake and full of vigour.

The obstacle that so often prevents us from estimating early scientific work at its true value is essentially twofold. In the first place, only a fraction of the literature of the subject has been rendered easily accessible. To appreciate fully the labours of a medieval natural philosopher therefore entails no little research into original documents, a task for which few men of science have either the time or the inclination. Scholars and historians, on the other hand, are as a rule not interested in scientific literature, and even if they were, they usually lack the necessary knowledge of science. From this *impasse* there appears to be only one escape: historical research in science must receive full recognition as an integral part of science itself. We shall then very quickly attract the necessary men, and shall obtain results which will prove of incalculable benefit not only to science but also to the whole cause of human civilisation. A start in this direction has fortunately already been made at the University of London; other universities cannot afford to be left behind.

The second difficulty is not quite so easy of solution. In brief, it is that scientific thought is bound to vary, not merely in content, but also in form and character from age to age, for it must necessarily be influenced by the general intellectual background of the time. This influence is, of course, reciprocal, but if the philosophy and habits of thought of a particular age are very different from our own, we are inevitably led to judge the scientific work of that time by standards which are in reality quite inapplicable. In chemistry, for example, it is easy to place a true value upon the work of Lavoisier and Dalton, for their ideas, aims and methods are fundamentally our own. It is much more difficult to appreciate the outlook and achievements of Becher and Stahl; our equipment of facts is so great that we find it practically impossible to denude ourselves sufficiently. When we go back to still earlier times, the difficulty becomes well-nigh insuperable. The whole intellectual *milieu* is foreign to us; we can understand neither the aspects of the problems which presented themselves nor the mental satisfaction of the solutions which were suggested.

An immediate key to this perplexing matter is that gift of sympathy which enables a man to transport himself to the Middle Ages and share the thoughts and aspirations of Gerard of Cremona, Adelard of Bath, and their contemporaries. This gift, alas, is all too rare, but if those who have it will translate their experiences into language intelligible to the rest of us, we may succeed in acquiring it at second hand. If, in addition to sympathetic insight, a man possesses also a sound scholarship, we may expect from him a flood of light upon medieval science. Such a man is Prof. Haskins, and his book justifies our anticipations.

As Prof. Haskins remarks in his preface, the history of European science in the Middle Ages is twofold. In the first place, it must deal with the recovery and assimilation of the science of antiquity in the course of the twelfth and thirteenth centuries; secondly, "it has to take account of the advance of knowledge by the processes of observation and experiment in western Europe." The scientific renaissance of the twelfth and thirteenth centuries was a very remarkable event, and at present very little is known about it, except that it certainly happened. Its importance can scarcely be exaggerated, for it appears that at least two new sciences were actually introduced into Europe during that time, namely, algebra and chemistry.

In the transmission of ancient learning from Islam to Europe, Englishmen played a prominent part. Adelard of Bath, for example, who has been called "the greatest name in English science before Robert Grosseteste and Roger Bacon," was a prolific translator of mathematical and astronomical works from the Arabic. Prof. Haskins has collected together all the available information about this rather shadowy figure, and we are surprised at both the extent and depth of Adelard's scientific knowledge. It is particularly interesting to learn that he shows the influence of the atomic theory of Democritus, for atoms were generally at a discount during the Middle Ages. He possessed a rationalistic habit of mind and subordinated authority to reason. "I call myself a man of Bath," he says, "and not a Stoic, wherefore I teach my own opinions, not the errors of the Stoics." Other Englishmen who

engaged in the task of translation were Robert of Chester (who is said to have translated for the first time a book on chemistry), Roger of Hereford, and Daniel of Morley.

Although the main stream of translations came from Moorish Spain, Prof. Haskins does not neglect the subsidiary sources. Some Arabic knowledge, for example, came direct from Syria; a great deal more was transmitted through Sicily, especially during the time of Frederick II., to whom and his famous astrologer, Michael Scot, two chapters in the present book are devoted. In spite of his busy political and military life, Frederick found time to take an intelligent interest in the scientific thought of the day, and had sufficient independence even to correct Aristotle when experience proved that the prince of philosophers was wrong—"we have followed him where required, but not in all things, for we have learned by experience that at several points he deviates from the truth." To disagree with Aristotle in the thirteenth century required a not inconsiderable moral courage. Frederick's experiments were numerous and occasionally startling, but they were always devised with a definite aim. He exploded the old fable that barnacle geese were hatched from barnacles by the simple expedient of sending north for some barnacles, while "whether vultures find their food by sight or by smell he ascertained by seeling their eyes while their nostrils remained open."

On Michael Scot, Prof. Haskins has a good deal new to say, and in many instances he is able to correct earlier writers. Scot worked both in Spain and in Sicily, and did much to make the *De animalibus* of Aristotle known to the Western world. His connexion with alchemy is doubtful, although many works on this subject are attributed to him. As an astrologer, however, he became famous throughout Europe. To test his skill in astronomy, Frederick ordered Scot to "calculate the height of the starry heavens—whatever that may mean—by the tower of a certain church, and then had the tower cut off somewhat and casually brought Scot back to the site. Scot took his observation and answered that either the heavens were more distant or the tower had sunk a palm's measure or less into the earth, both of which were impossible, whereupon the emperor embraced him in admiration of his skill."

Prof. Haskins, it will be observed, while writing primarily for the specialist, has seasoned his pages with many a pleasant anecdote, and the general reader may skip the footnotes (and the passages in Latin if he likes) and still gain profit and enjoyment from his reading. To the historian of science, however, the work will prove invaluable. The full bibliographical references alone are worth careful study, for Prof. Haskins knows his literature, both printed and manuscript, as few others can do. The help which is provided in this direction will prove as attractive to the scholar as will the interesting information on falconry (Chaps. xiv. and xvii.) to the plain lover of the Middle Ages.

Medieval science, it is true, often appears to us to be puerile, but that is because we view it from the wrong angle. Our system of orientation has changed, but science is a living tradition firmly rooted in the past. Let us put ourselves in the place of these medieval men of science, and we shall form a better conception of their services to the cause. "La nature," says Hoefer, "est aujourd'hui ce qu'elle était autrefois. Les anciens avaient les mêmes yeux que nous pour la voir, mais ils n'avaient pas la même manière de la comprendre: *la pensée humaine, voilà ce qui varie.*"

E. J. HOLMYARD.

Our Bookshelf.

Department of Marine Biology of the Carnegie Institution of Washington. Vol. 20: American Samoa. Part 1: Vegetation of Tutuila Island; Part 2: Vegetation of the Samoans; Part 3: Vegetation of Rose Atoll. By Prof. W. A. Setchell. (Publication 341.) Pp. vi+275+37 plates. (Washington: Carnegie Institution, 1924.) 3.50 dollars.

THE Carnegie Institution has again materially added to our knowledge of the vegetation of the more outlying parts of the world by the publication of three treatises on American Samoa by Prof. W. A. Setchell. The first and third parts are devoted to the vegetation of two islands, Tutuila and Rose Atoll, and provide a comprehensive review of the nature and distribution of the flora and enumerations of the species recorded. In addition to his own work, the author has incorporated that of previous workers in this locality, and has received the assistance of specialists in the description of the general habitat factors and the enumeration of the species.

In all too few cases have we records of this nature. Throughout the tropics our information on the vegetation is so frequently only to be found as a brief sketch in the introduction to an official handbook or guide. It is by the aid of such unit works as Prof. Setchell's that we shall gradually be able to obtain a due appreciation of the vegetation of such areas and, by piecing such units together, acquire sufficient knowledge to map out the vegetational areas and their connexions that are at present unknown. In each of these discussions the author has described the general habitat factors and then sketched the vegetation in its broader aspects and, where data have permitted, in more detail. This analysis has been based on the phanerogams recorded, for, as he remarks, our knowledge of the cryptogams is not sufficient at present to assist in this direction.

In an interesting review of the affinities of the Samoan flora, the author gives some negative characteristics which indicate the probability of an insular flora of the Pacific, though, as he points out, there is still much to be studied in this direction. Only eight new species

are recorded among the phanerogams, but there are a considerable number of new cryptogams, especially algæ.

The second treatise is devoted to the ethnobotany of the Samoans, and provides a record of the economic uses to which plants have been put. It is becoming more and more difficult, as civilisation transforms the habits of native races, to obtain such information, and any such records are to be welcomed.

An index of Samoan plant names is given in addition to the botanical index and greatly enhances the value of the work. There are thirty-six photographic reproductions in addition to text figures.

The Ethnography of South America seen from Mojos in Bolivia. By Erland Nordenskiöld. (Comparative Ethnographical Studies, 3.) Pp. vi+254+30 maps. (London: Oxford University Press, 1924.) 18*s.* 6*d.* net.

THE third part of Baron Nordenskiöld's comparative ethnographical studies of South America is in some respects the most interesting of the series. It is an illuminating example of the use to which, in skilful hands, distribution maps can be put in elucidating the cultural history of an obscure ethnographical area. In north-east Bolivia there is a large number of tribes, some belonging to recognised linguistic groups, others speaking isolated languages. The explanation of the considerable differences in culture among these is to be sought in their history rather than in the influence of geographical conditions which, broadly speaking, are identical throughout. The country consists for the most part of plains, which at one time in parts were subject to inundation. Hence mounds were erected for purposes of cultivation. The Seriono, who represent the most primitive stage among the tribes, alone raised no crops and subsisted by hunting. The tribes now have iron; the stone which they formerly used was all imported as there is none in the country. It is interesting to note that a stone-grinding industry still exists.

In his valuable analysis of their culture the author has plotted the distribution of such elements as dwellings, cultivation, hunting implements, weaving, fishing weapons, appliances connected with fire and the like. The result is a mass of valuable information relating to each. In addition a number of general conclusions emerge; thus while there are evidences of a cultural influence from the west and especially the north-west, only a few of the numerous elements of western culture which are found in the Chaco occur in N.E. Bolivia. As might be expected, the small tribes speaking isolated languages represent a very old stratum from which elements have been adopted by Arawak and Guarani. On the other hand, many of the tribes show signs of having been influenced considerably by the Guarani.

Lighting in Relation to Public Health. By Prof. Janet Howell Clark. Pp. 185. (Baltimore, Md.: Williams and Wilkins Co., 1924.) 4 dollars.

THIS book is intended to suit the needs of the public health worker, and is a recapitulation of the course of lectures delivered to students studying for the degree of doctor of public health at the Johns Hopkins University. The first four chapters deal with the technical side of illumination, and succeed in conveying a very good account of the methods to be adopted in light measurement, and also of the advantages and disadvantages of the various illuminating systems, and one which easily can be followed without any special technical knowledge. The next three chapters deal with the questions of glare, sufficient illumination, and the best conditions for visual efficiency, the last including a brief account of the important work of Ferree and Rand on the measurement of ocular fatigue. Other chapters describe the best methods of illumination for schools, factories, and other interior and exterior purposes.

As regards intensity of illumination the author points out that though visual acuity, as tested by letter charts, increases with illumination and reaches a maximum at about 5 foot-candles, speed of discrimination increases rapidly up to 2 foot-candles and after that more slowly, but is still increasing at 18 foot-candles. Thus, in occupations where speed of discrimination is required, light up to 20 foot-candles may be employed with advantage. The remainder of the book gives a brief but good account of eye diseases attributable to light conditions, such recent work as that of Healy, Cridland, and St. Clair Roberts on cataract in tinplate millmen, iron-smelters, and chain-makers receiving mention. Some recent experimental work by the author on the coagulation of egg albumin by ultra-violet light is quoted as lending some support to Burge's theory on the causation of lens opacity.

We can cordially recommend the book as an adequate handbook to a subject that has only recently begun to obtain the attention it deserves. The publishers are to be congratulated on the excellence of both illustrations and type.

Timbers: their Structure and Identification. By W. S. Jones. Pp. xi+148. (Oxford: Clarendon Press; London: Oxford University Press, 1924.) 15*s.* net.

THIS handbook is intended for forestry students who are engaged in a course of microscopical work on a selected group of timbers, comprising 24 European, 26 Indian, and 7 American broad-leaved trees, and 14 genera of conifers. The methods of preparing sections and microphotographs for the elucidation of structural details are carefully explained, as well as illustrated by 165 figures in the text. The lack of a comprehensive key to the whole of the genera is regrettable. The genera Salix and Populus, for example, are not distinguished in p. 73. It was scarcely worth while reprinting on p. 35 Hartig's inadequate key of forty years ago. An effort should be made in the next book that is published on the identification of timbers, to combine in one table the various keys that have been published of late years, notably Kawai's diagnosis of 200 species of Japanese broad-leaved woods and Kanehira's elaborate tables of 386 species of Formosan woods and 100 species of the more important Indian woods. Koehler's identification of North American woods, which appeared at Washington in 1917, might also be consulted. Without some such general view of the distinguishing characters of numerous species of woods, the palæobotanist, the archæologist, the timber merchant and the furniture dealer are put to great inconvenience in determining with accuracy unknown specimens of woods. This handbook, nevertheless, may be recommended to students who are interested in the structure of timbers.

Letters to the Editor.

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Permo-Carboniferous Glaciation and the Wegener Hypothesis.

IN a recent number of NATURE (February 21, p. 255) there is a very interesting review by Prof. J. W. Gregory of an English edition of "The Origin of Continents and Oceans," in which important objections are brought forward against the supposed drift of continents and shifting of the earth's poles. The suggestion is made, however, that the theory will "probably give a new lease of life to the explanation of the Carboniferous glaciation of India and some parts of the Southern Hemisphere, by the shifting of the Pole; for arguments, which are unanswerable against that explanation with scattered continents, do not apply to Prof. Wegener's single continent."

The same view is held by Dr. du Toit, who has done excellent work in investigating the Dwyka glaciation in South Africa.

In preparing a forthcoming work on ancient glaciation, I have made a detailed study of the Permo-carboniferous ice age, and have reached conclusions which are quite at variance with this idea.

In the first place, it has been proved that ice sheets on all the continents supposed to unite about the south pole *reached sea level*. This is true of India, South Africa, South America and Australia, and in the latter two the ice touched the sea on both sides of the continent, as proved by fossiliferous marine deposits associated with the tillites.

The usual idea of a vast and lofty Gondwanaland on which an enormous ice sheet could arise must be given up; for the different glaciated areas were separated by oceans or at least by arms of the sea in which marine animals survived.

In the second place, an examination of maps of the supposed south polar continent prepared by Prof. Wegener (German edition) and Dr. du Toit shows an area of land far greater than Eurasia at present, with glaciation reaching a latitude of at least 45° on more than one lobe. In the case of South Africa, all the known ice motion was *southward*: and it is evident that the northern half of the African ice sheet has not yet been worked out, since the region is forest-covered and almost unexplored. It is altogether probable that ice reached as far to the north as it is known to have moved toward the south. This would carry the ice sheet at least ten degrees beyond the region mapped, say to latitude 35°.

It should be remarked further that, in most of the supposed Gondwanaland, as shown on the two maps mentioned, the glaciated areas would be far inland and out of reach of the moisture-laden winds necessary to deposit snow. They would be arid regions without permanent snow fields, like the interior of Asia, which was not glaciated in the Pleistocene though one of the coldest regions of the world.

It is evident, then, that the drift of continents and the shift of the poles do not help us to account for the Permo-carboniferous glaciation.

Prof. Wegener's account of the causes of Pleistocene glaciation is even less in accord with the facts. His arrangement of the shifting poles and continents gives Patagonia a mild climate while Canada was being glaciated, and allows the ice to invade South America only at a much later time. A study of the American Pleistocene shows that two times of glaciation separated by an interglacial period occurred all the way along the Cordillera from Alaska to Tierra del Fuego, even Peru and Bolivia showing two sets of old moraines of different ages on the loftier peaks of the Andes. All geologists who have examined the Pleistocene deposits in South America as well as those of the north are agreed that they are of the same age and not separated by a million or more years as demanded by the theory of shifting poles.

It may be confidently stated that a careful study of the two greatest periods of glaciation known to geology gives no support to the theory of the drift of continents and the wandering of the poles.

A. P. COLEMAN.

University of Toronto.

I DID not mean to suggest that the lengthening of the life of the hypothesis would prove its truth, as I agree with Prof. Coleman in doubting the shift of the Pole in Carboniferous times; but the popularity of the theory will probably be increased by the removal of one line of argument against it.

J. W. GREGORY.

International Co-operation in Phenological Research.

THE response to our orginal appeal (NATURE, Oct. 25, 1924, p. 607) has been gratifying. Offers of co-operation range from Norway and Lithuania to Cape Colony and Australia; from Vancouver, Winnipeg, and Fargo (N. Dakota) to Lahore, Calcutta, and Batavia (Java). It has brought us into touch with many workers previously unknown to us, and ancient records, including an almost unbroken series carried on in the same family, on the same system, in the same place, from 1737 to the present day. We should like therefore to put forward for mutual discussion suggestions for future co-operation.

The plant observations made independently in different countries have been selected naturally from those best fitted for comparison with crop growth in the given country. In the same continent these lists include several common to all, allowing of a certain amount of inter-correlation. We must aim so to select the number that not only continental but intercontinental correlations will be established on a firm basis. When this is done, important equivalencies (such as Dr. A. D. Hopkins' classic example of wheat sowing and the Hessian fly) will become available over world-wide areas, where now they can only be applied locally, although he has already shown possibilities, particularly between the United States and Western Europe.

For this purpose we would suggest tentatively that an international list, including some forty subjects for observation, be drawn up, which might be expected to embrace at least some twelve to twenty fairly common in each of the associated countries, at least when situated in the temperate zones. Even ten, well distributed over the growing and fruiting months, would serve well for correlation.

For this purpose garden as well as wild flowers must be utilised, as being so widely introduced, though a number of the commonest are unsuited because of the many varieties in cultivation, and consequent variation in dates of leafing, blooming, and fruiting.

If such an international list is drawn up and each country collects and digests the results through its own Association, then in ten years or so statistics

will have been brought into existence adapted to international comparison and the time will have come for the yet closer international co-operation already established in allied natural sciences such as meteorology.

Meantime each country would continue its present series of observations, while the observing members would be invited to observe also, either as a separate series or embodied in their own lists, a selection from the international list most available and not already under observation.

That there may be a basis for discussion the following list has been drawn up from those actually in use in Italy, the Tyrol, Central Europe, and Great Britain. Criticism and alternative suggestions will be highly valued.

PHENOLOGY AND AGRICULTURE.

Suggested observations to correlate series A and B.

A. FARM GROWTH PHENOMENA :

(1) *Grain crops :* dates of sowing (autumn and winter), appearance, ears showing, flowering, harvesting.

(2) *Root crops :* (say sugar beet) sowing or planting, appearance, digging.

(3) *Meadow hay :* flowering of sweet vernal grass (*Anthoxanthum odoratum*) and Timothy grass (*Phleum pratense*) ; hay-cutting.

B. FLOWER PHENOLOGY of wild and garden flowers of wide distribution. Tentative list arranged by approximate date (day of year) of flowering in Great Britain.

	Common and Botanical Names.	Day of Year.
1	†Snowdrop (*Galanthus nivalis*)	19
2	†Winter aconite (*Eranthis hiemalis*)	20
3	Yew (*Taxus baccata*)	30
4	†Yellow crocus (*Crocus aureus*)	33
5	Common elm (*Ulmus campestris*)	44
6	*Hazel (*Corylus avellana*)	44
7	†Celandine (*Ranunculus ficaria*)	47
8	*Coltsfoot (*Tussilago farfara*)	65
9	Cherry plum or purple variety (*Prunus cerasifera* or var. *P. Pissardi*)	70
10	Bracken (*Pteris aquilina* (shows))	80
11	Almond (*Prunus amygdalus*)	85
12	White poplar (*Populus alba*)	85
13	Black poplar and Lombardy poplar (*Populus nigra* and var.)	90
14a	*Wood anemone (*Anemone nemorosa*)	92
14b	Goat willow (*Salix caprea*)	100
15	*Blackthorn (*Prunus spinosa*)	102
16	Flowering currant (*Ribes sanguineum*)	110
17	Sessile fruiting oak (*Quercus robur*)	115
18	Stem fruiting oak (*Quercus pedunculatus*)	115
19	Red currant (*Ribes rubrum*)	115
20	*Garlic hedge mustard (*Alliaria officinalis*)	120
21	Crab apple (*Pyrus malus*)	130
22	*Horse chestnut (*Æsculus hippocastanum*)	133
23	Common lilac (*Syringa vulgaris*)	130
24	Quince (*Cydonia vulgaris*)	135
25	Laburnum (*Cytisus laburnum*)	138
26	*Hawthorn (*Cratægus oxyacantha*)	139
27	Raspberry (*Rubus idæus*)	150
28	*Ox-eye-daisy (*Chrysanthemum leucanthemum*)	154
29	Elder (*Sambucus nigra*)	160
30	*Dog rose (*Rosa canina*)	163
31	Snowberry (*Symphoricarpus racemosus*)	165
32	Guelder rose (*Viburnum opulus*)	165
33	*Black knapweed (*Centaurea nigra*)	190
34	Madonna lily ((*Lilium candidum*)	195
35	*Greater bindweed (*Convolvulus sepium*)	198
36	Sweet chestnut (*Castanea vesca*)	200
37	Montbretia (*Tritoma montbretia*)	200
38	Autumn crocus (*Colchicum autumnale*)	245
39	Autumn Caucasian crocus (*Colchicum speciosum*)	250
40	*Ivy (*Hedera helix*)	276
41	Winter (yellow) jasmine (*Jasminium nudiflorum*)	280
42	Christmas rose (*Helleborus niger*)	350

* These twelve are in the Roy. Met. Soc. chief phenological list, observed from 1891.

† In supplementary list.

Even if only a dozen can be used, their value would be material.

Grain Crops.—Possibly the British Ministry of Agriculture will supply agricultural colleges, etc., every year with seed specially grown. Every year the various stages of a given sort should be observed on the same plot.

For No. 22, and if possible with other trees, the leafing, fruiting, colouring, and leaf-fall of the same specimen or group should be recorded.

No. 9. On seven years' records at Purley these were identical in average date.

Nos. 17 and 18. Which is most widespread ?

No. 26. In more southern areas, as Tyrol and Italy, unfortunately displaced by the later *C. monogyna.*

As ushering in the second quarter of this century, 1926 naturally suggests itself as an appropriate year for starting such co-operation. Work would therefore begin next December in the northern hemisphere, and the following June in the southern.

One very valuable help at the present stage in criticising the list will be to forward us the names of such of the forty or so as could and would be observed in different districts and countries.

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Depth-recording with Plankton-nets.

IT is well known that there is great variation in the vertical distribution of various plankton organisms, but up to the present the actual depths from which net-collections have been made has never been known with certainty. To help in the study of the vertical distribution of marine zoo-plankton, the Admiralty very kindly sanctioned the loan of an instrument which records graphically, on a drum worked by clockwork, the depth at which a net has been fishing during the whole of its period under water. Results obtained with this apparatus indicate the necessity for an accurate knowledge of the depth at which the net has fished.

While collecting last year I used the recorder regularly, and a few facts have come to light as to how the net behaves when fishing.

The net in use was that known as the ring-trawl, a conical bag 9 metres in length, with a diameter of 2 metres at the mouth. It was made of " stramin " (hemp-sacking *ca.* 16 strands to one inch). To the end of the net was attached a galvanised iron bucket. It was towed on a single warp of 2-inch (circumference) wire from the port drum of the large trawl winch. At the junction of the bridle with the warp was attached a weight of ½ cwt. on a short length of rope, and at this junction also was fixed the depth-recorder.

When a net is being towed, there are three main forces in action : the forward and slightly upward pull of the boat, the downward pull of the weight, and the backward pull of the net, wire, etc. Whereas the force due to the weight is constant from day to day, the two remaining forces depend upon the rate at which the net moves through the water ; this in turn is dependent upon the rate of the towing-ship through the water, not over the ground, and the clogging of the meshes of the net. The speed of the ship through the water is influenced by the strength of the wind and, when the net is fishing deep, by the drift, if any, of the surface water relative to the deeper layers.

The ship from which we work is a large wooden steam-drifter, the s.s. *Salpa* ; when fishing with the above net the engine is used as motive power, except when the wind is so strong that it is possible to drift. The ship generally steams with the wind behind, because if she towed against the wind at the slow

speed necessary, she would be constantly falling off to either side, so necessitating extra manœuvring to prevent the warp coming under the stern and fouling the screw.

Under favourable conditions the engine is run dead slow; that is, as slow as it will run without stopping. It is the practice for the captain, as near as he can judge, to keep the angle of entry of the warp into the water constant (*ca.* 40°). It is probable that by this means the filtering of the net will be as nearly the same as possible from day to day, as it must mean that the speed of the net through the water is fairly constant, and catches made on different days should therefore be comparable quantitatively.

This constant speed can be kept by adjusting the revolutions or actually stopping the engine for a few moments as the angle of the warp changes.

Working in this manner through a large number of hauls, the graphic records of depth of fishing have

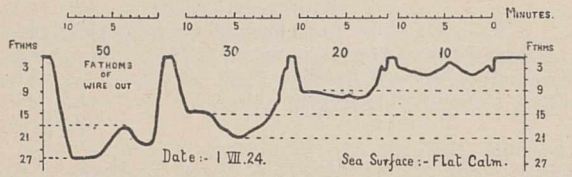

FIG. 1.

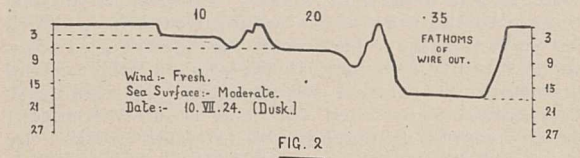

FIG. 2

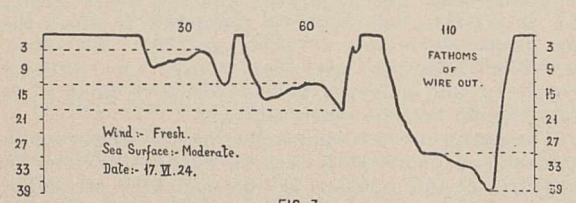

FIG. 3.

FIGS. 1, 2, and 3 are tracings of records obtained during three series of hauls. Each haul, represented by a curve, is of ten minutes' duration (time of "shooting" and "hauling" not included). The net enters the water on the right-hand side of each curve. Above the curve for each haul is inserted the length of wire used, in fathoms.

shown very varying results. On some occasions the net has followed a wavy path, fishing through as great a vertical range as 9 or 10 fathoms; on others, the level kept by the net has been as perfect as could be wished for. Further, the seemingly paradoxical facts have arisen that on a day when the sea surface was like glass and conditions seemed most favourable, one of the worst results was produced; whilst under conditions of wind and swell such that work was almost abandoned, and furthermore in semi-darkness, the level kept by the net was as good as any obtained. These two instances are illustrated in Figs. 1 and 2; these tracings represent two series of hauls each of ten minutes' duration, and should be read from right to left, the net entering the water on the right-hand side of each curve and leaving it on the left. In Fig. 1 the haul with 30 fathoms of wire out is an example of a bad result: in this instance the net began fishing with the engine at the usual "tow-net" speed, but after five minutes, the angle of incidence of the warp appearing visibly greater than that usually kept, the engine was speeded up slightly, with the result that the net, which had sunk to 21 fathoms, was now slowly raised to a level of 15 fathoms, where it remained until the end of the haul. This behaviour is a little hard to understand when we look at the haul with 20 fathoms of wire out; here the net was towed with the engine at the same speed as at the beginning of the haul we have just examined, but instead of sinking, as it did on that occasion, it remained nearly level, rising very slowly throughout the duration of the haul.

Fig. 2 illustrates the curiously perfect results obtained in very unfavourable circumstances.

It seems quite probable that if no attempt be made to adjust the angle of incidence with the engine, the net will find an equilibrium level, under the weather conditions prevailing at the time, and will fish there. This may account for the good results shown in Fig. 2, in which case the equilibrium level was found when the warp was at the angle usually aimed at. Therefore to fish a net at a constant level under different conditions of wind and sea, the length of warp required to keep the net at a given depth will vary considerably; how much this variation may be has been shown by some of my results. For example, in Fig. 1, in the haul with 30 fathoms of wire out, if the warp had not been watched and the net had been allowed to find its own level, it would possibly have sunk deeper than it did; as it was, it had reached a depth of 21 fathoms, and this with 30 fathoms of wire out, so that the ratio of depth to warp out was 2 : 3. In Fig. 3, however, with a very fresh wind blowing, it was not possible, even without the engine, to keep the angle of incidence of the warp anywhere near that at which we usually aim. If we look at the curve for 30 fathoms of wire out, we find that on one occasion the net rose as high as to 4 fathoms; this gives a ratio of 2 : 15, very different from that cited above.

In two cases the angle of incidence of the warp was measured as accurately as possible, and in both cases the depth estimated from the angle, on the assumption that the warp followed a straight line from the ship to the net, was very different from that actually shown by the recorder; in one case the estimated depth was 20 fathoms and the actual depth 14.

From the above results it would seem that with large tow-nets of the type used in this case, it is impossible to estimate the depth of the net with a sufficient degree of accuracy, at any rate for coastal work on plankton distribution. Possibly with small nets, a weight out of all proportion to the size of the net will keep the wire nearly vertical and the net steady, but with large nets like the ring-trawl, the weight would of necessity be too great for man-handling in everyday work.

This would point to the necessity of having some simple and easily manipulated recorder designed of small enough size to be used when a string of nets is being fished.

F. S. RUSSELL.

The Laboratory, Citadel Hill,
Plymouth, February 25.

Spectroscopic Evidence of *J*-Transformation of X-rays.

The relation between the atomic number of a radiator and the wave-lengths of its X-ray emission spectrum of *K*-series is generally assumed to be the regular one described by Sommerfeld's extension of Bohr's idea to X-ray spectra. Well-marked irregularities, however, have not received attention in

the literature of the subject; it is the object of this note to direct attention to them.

Fig. 1 shows the variation of the wave-lengths Ka_1, and $K\alpha$ (absorption limit) with atomic number (Z) of radiator from Z = 40 to Z = 60; the plotted values

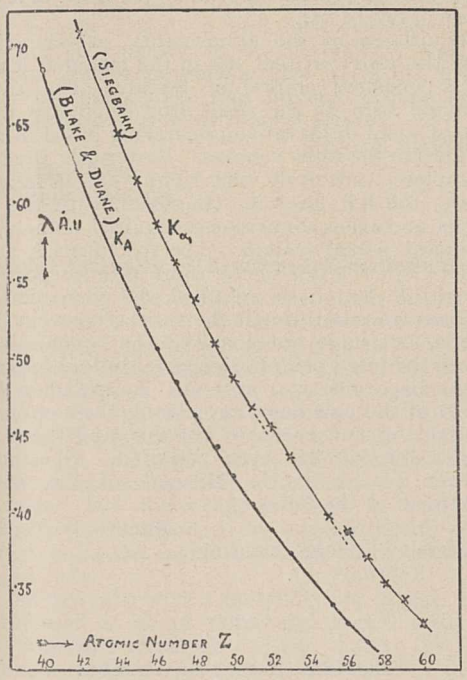

FIG. 1.

are from Siegbahn, and Blake and Duane respectively. Fig. 2 is an enlargement of Fig. 1, to show more clearly the irregularities which we shall proceed to describe. If we follow λ for Ka_1, as Z is increased from 40, we notice that at Z = 52 and at Z = 56 there takes place a sudden increase in λ relative to the value which would have occurred, were the simple relation for smaller atomic numbers obeyed. The magnitude of this excess is about 0·01 Å.U. in each case. Exactly the same irregularities occur in Ka_2 and $K\beta$, but not in $K\alpha$. Lack of data prevents any definite conclusion with regard to $K\gamma$. The degree of precision claimed for these spectroscopic observations is too high to admit of any other conclusion than that these irregularities are real deviations from the simple law.

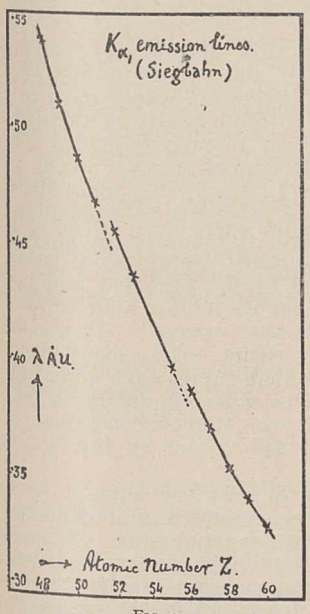

FIG. 2.

It is certainly no fortuitous coincidence that the wave-lengths at which these sudden increases take place, correspond very well with two of the critical absorbabilities for *J*-transformation, which in the case of aluminium are $(\mu/\rho)_{Al} = 1·9$ and 0·7 (see Bakerian Lecture by Barkla, Phil. Trans., 1917, and Barkla and White, *Phil. Mag.*, 34, Oct. 1917), and are only very slightly displaced by change of the atomic number of the transmitting element except when this is small. The atomic structure of the radiator cannot be supposed responsible for the irregularities referred to, for, at the atomic numbers indicated, there is no readjustment of electronic distribution according to the Bohr scheme. As there is no reason, either theoretical or practical, for the occurrence of these irregularities, apart from the *J*-transformation, and as they appear precisely in the same place as in the experiments showing *J*-discontinuities, one can only conclude that these irregularities are due to the *J*-transformation of X-radiation taking place in the calcite crystal used for the analysis of the radiation or possibly in the anticathode or walls of the X-ray tube. We have, however, no information of the crystal used by Blake and Duane for the measurement of $K\alpha$.

This seems to be the first spectroscopic evidence of the *J*-transformation, which by absorption methods has been found in primary rays (Barkla, Silvanus Thompson Lecture, NATURE, Nov. 22, 1924) and in scattered rays (Barkla and Khastgir, *Phil. Mag.*, 49, Jan. 1925). This also strongly supports the view expressed by Barkla (NATURE, Nov. 17, 1923, and Nov. 22, 1924) that the apparent increase of wave-length as observed by Compton and others in the scattered radiation is due to the same *J*-transformation during transmission in the crystal or in the radiator, and is not part of the phenomenon of scattering at all. That the magnitude of the change appearing in the curves shown here is of the order of the Compton shift, gives further support to this contention. It must be understood, however, that the attainment of a critical wave-length is not the only factor which determines whether or not the transformation takes place.

S. R. KHASTGIR.
W. H. WATSON.

Physical Laboratory,
University of Edinburgh,
March 27.

Acidity produced in Salt Solutions by Sphagnum.

THE fact that Sphagnum or peat shaken with a neutral salt gives rise to an acid reaction in the solution has long been known. Baumann and Gully first explained this phenomenon as due to the adsorption of the base by colloids and the liberation of the acid. This view has been the subject of much criticism, especially by Odén, who regards the acidity as due to the presence of organic—humic—acids. An important argument of Odén is that no proof has been offered that the acid of the salt employed is ever present in the free state in the solution. We have been able to provide this proof by two different methods.

If a weak solution of copper chloride (0·025 per cent.) is shaken with Sphagnum it becomes acid to methyl orange. Colorimetric estimation shows that 75 per cent. of the copper has disappeared: determination of the chloride shows that it is still present in the original strength. The presumption is strong, therefore, that the acidity is due to free hydrochloric acid. As, however, the free acid, as estimated by titration, does not account for the whole of the chloride, the proof is not definite. It has been found that a secondary reaction resulting in the neutralisation of part of the acid takes place.

When the sodium salts of different acids are shaken with Sphagnum, different amounts of acid are liberated; much more acid is liberated from the acetate than from the chloride. It was found, on the other hand, that the hydrion concentration was much greater in the second case than in the first. The exact results for a

series of salts may be given. In each case 1·5 gm. of *S. cymbifolium* was shaken with 100 cc. of N/10 salt. The acid was titrated with sodium hydroxide, and is expressed as a fraction of normality. The borate was titrated after addition of manitol. The hydrion concentration was determined colorimetrically.

Acidity produced in salt solutions by *Sphagnum cymbifolium*:

Salt (N/10).	Titration Value.	P_H Value.
Sodium chloride . .	0·00026	4·6
Sodium sulphate . .	0·0005	4·6
Sodium acetate . .	0·0065	5·5
Sodium citrate . .	0·0085	5·9
Sodium borate . .	0·015	9·4

The fact that high titration value goes with low hydrion concentration is very suggestive. A solution of sodium chloride and hydrochloric acid having the titration value shown was prepared and corresponding salt-acid mixtures of the other salts employed. The hydrion concentrations of these were determined, and were found to be 4·6; 4·6; 5·5; 5·9; 9·5, respectively. The agreement is very satisfactory, and seems to give definite proof that the acid present in the salt solution after shaking with Sphagnum is, in fact, the acid of the salt employed. The explanation of Rice, that a similar phenomenon in soils is due to the formation of acid aluminium salts, does not appear to be applicable here. The further implications of these results will be dealt with in a later communication.

MACGREGOR SKENE.
GLADYS L. STUART.

Botany Department,
University of Aberdeen,
April 3.

Three Cases of Abnormal Anterior Abdominal Veins in the Frog.

THE abnormalities here described were discovered during class dissection in this College. Of fifteen specimens dissected three showed abnormality in the anterior abdominal vein. All three specimens were females.

Specimen A. The anterior abdominal vein had no connexion with the liver, but emptied itself into the *left* subclavian vein.

Specimen B. Similar to A. In addition there was a transverse anastomosis between the external jugular veins.

Specimen C. The anterior abdominal vein sent a small vessel to the liver, but most of the blood passed into the *right* subclavian vein.

The abnormal specimens showed no other peculiarities.

Communications between the anterior abdominal vein and the right or left subclavian veins have been recorded by four observers, of whom three found one specimen each. Buller (*Journ. Anat. and Phys.*, vol. 30, 1896) found in a female specimen a condition similar to C, but opening nearer the heart, namely, into the superior vena cava at the entrance of the subclavian into it. Woodland (*Zool. Anz.*, Bd. 35, 1910) described the first abnormality (A) in a male frog, and O'Donoghue (*Zool. Anz.*, Bd. 37, 1911) the same condition in a male specimen, coupled, however, with an abnormal heart. Lastly, Collinge (*Journ. Anat. and Phys.*, vol. 50, 1915) reported one case in which the anterior abdominal vein gave off a large branch to the hepatic portal system and then sent a fine vessel into the right anterior vena cava, and another case where both right and left venæ cavæ received contributions, no blood going to the liver from the anterior abdominal vein. The abnormalities here in question are probably of rare occurrence, and it is surprising to find them in 20 per cent. of a batch of frogs (3 out of 15).

The interest of the abnormality, as was pointed out by the above writers, lies in the fact that it represents a persistent embryonic feature. The anterior abdominal vein of the adult frog originates by the fusion of a pair of larval veins carrying blood from the hind limb to the sinus venosus. Posteriorly the fusion is complete, anteriorly the right vein usually disappears, the left loses its connexion with the sinus venosus, and a new connexion is acquired, namely, with the hepatic portal system. The specimens A and B, therefore, show a loss of the right anterior portion of the ventral vein, have retained the connexion with the sinus venosus through the subclavian vein of the left side, but have not acquired the communication between the fused posterior veins (anterior abdominal) and the hepatic portal system. In specimen C the *left* vein of the pair has disappeared, the communication with the sinus venosus remains, and the hepatic portal connexion has been acquired. Specimen A has been placed in the Museum of the Zoology Department of the College.

NELLIE B. EALES.

University College, Reading,
February 27.

The Life-History of Amœba.

SINCE the full details of some experiments on *Amœba proteus* carried out upon numerous strains of Amœba, each strain descended from one single individual, will not be forthcoming for some time, it seems advisable to make a preliminary announcement of the following results obtained by my assistant, Miss Isabelle P. M'Guire.

On November 23, 1923, five glass dishes, ranging from 3 to 6 inches diameter, and height 3 inches, were provided with 50 c.c. of Glasgow tap-water, and 2 to 5 wheat grains, according to the capacity of the dish. These were left in a warm room over-night. On November 24 *one* adult amœba from Culture 11 (*Q.J.M.S.*, Vol. 69, Part I., Dec. 1924), plus about 25 c.c. of the culture water plus some food organisms upon which *A. proteus* feeds (these latter being carefully scrutinised and identified before being used), was inoculated into each of the prepared aquaria, care being taken to see that no minute amœbæ were included. Each dish was then covered with a glass plate and put into a warm (temp. 60° F.) shady place. Tap-water was added gradually until each aquarium became full of liquid. One wheat grain was added to each on the following dates: March 23 and June 10. Two wheat grains were added to each on July 4 and September 9.

In February and March 1925 the aquaria were examined. None of them contained adult amœbæ. In two of them, however, a population of small amœbæ were seen — recognisable under a $\frac{1}{6}$-inch objective. In two others encysted young amœbæ were visible amongst the debris. A few of these were transferred to a slide, and were kept in a damp chamber from March 12 last until March 16, on which date young amœbæ hatched out of the cysts. The fifth aquarium was a blank: no amœbæ or encysted young amœbæ were found.

Since Miss M'Guire is working in Notre Dame Laboratory, where cultures are constantly set up, it

was not deemed necessary to have control experiments other than those employed for the general culture work. It has been observed over and over again that an aquarium inoculated with food organisms only does not produce a population of *Amœba proteus*. In my prolonged work upon the life-history of *A. proteus* I have failed to find any evidence of the occurrence of syngamy in its life-history, and it is clear that the experiments now recorded greatly increase the probability that no such process occurs in the normal life-cycle of *Amœba proteus*.

MONICA TAYLOR.

Notre Dame,
Dowanhill, Glasgow.

Total Intensity of Scattered X-radiation.

IN a report by Duane (Proc. Nat. Acad. Sci. 10, 378, 1924) mention is made of the intensity of scattered radiation inside a closed box containing an X-ray tube. He states that "the amount of this box radiation that passes out through the slits into the spectrometer appears to be sufficient to dominate more or less completely the spectrum obtained." He then cites a number of instances where remarkably intense scattered radiation has been observed.

We offer the following instance as additional evidence of the comparatively large intensity of the scattered radiation inside a closed room containing an X-ray tube.

A Coolidge tube with a molybdenum target, which was operated at about 5 ma. and 25 kv. peak, was placed in a room about 22 × 25 feet and 10 feet high. The tube was located about 2 feet from one side and equidistant from the ends of the room. The height of the tube above the floor was about 4 feet. We observed that a photographic film placed some 50 cm. from the tube and shielded from the direct rays by proper lead screens was almost completely blackened in three minutes. We also found it possible to observe the scattered radiation at distances so great as two metres from the tube by means of a fluoroscope, the direct radiation being cut out by a sheet of lead placed directly in front of and in contact with the fluoroscope. This indicates that the intensity of the scattered radiation inside the room is nearly of the same order as that of the direct radiation. However, in this experiment, as in the cases cited by Duane, the effect of the scattered radiation is integrated over a solid angle of 2π. The solid angle in the case when the radiation proceeds through slits is much less than 2π, and so the intensity is probably not sufficient to modify the scattered spectrum as Duane suggests.

O. K. DEFOE.
W. W. NIPPER.

Washington University,
Saint Louis, Missouri,
February 12.

The Auroral Green Line.

DR. SHRUM and I have found that the line $\lambda = 5577$, which we think is identical with the auroral green line, can be obtained with a mixture of oxygen and helium (with the latter greatly in excess), just as intense at room temperatures with a suitable pressure as when the discharge tube is surrounded with liquid air. Moreover, the results of our experiments strongly indicate that this spectral line has its origin in oxygen.

J. C. MCLENNAN.

The Physical Laboratory,
University of Toronto,
April 4.

The Mortality of Plaice.

I KNOW of no facts in the natural history of male plaice which would render untenable the logically flawless hypothesis of Dr. Bidder (NATURE, April 4), to the effect that it is what he calls "parental death" which occurs in this sex. In females the question of parental death is still in doubt unless "as the fish grows larger" (I quote Dr. Bidder) "k diminishes, and reaches 1·0 at a constant ratio of ovary-weight to body-weight which allows the residual body to recover after spawning." In this connexion I can only state that one occasionally encounters greatly emaciated very old females (called by fishermen "slinks") which have all the appearance of not being "long for this world." This observation, however, merely *suggests* that in the largest fish "ovary-weight *may* bear a lethal ratio to body-weight," the possibility of which is admitted by Dr. Bidder.

Perhaps I may now be permitted to suggest to Dr. Bidder one possible implication of his hypothesis as to the non-liability of the females to either parental or senile death. One consequence on an unfished area might be that the area would tend to become monopolised by a comparatively few females of immemorial antiquity, prodigious size, and devastating activity (since the larger the size the greater the activity necessary to procure food to maintain it). In these circumstances the adolescent females and mature males, necessarily restricted in their diet to the smaller molluscs, etc., would not stand a chance against the voracity of the giant "methuselahs" with their capacity for ingesting and digesting both large and small organisms. I suggest that this competition *intra* species would prove fatal to its existence.

WILLIAM WALLACE.

Fisheries Laboratory,
Lowestoft,
April 7.

Robert Browning as an Exponent of Research.

IN "Robert Browning as an Exponent of Research" (NATURE, February 28, p. 298) why was it written ?

"As still to its asymptote speedeth the curve."

The curve itself is full of exponents, but is it asymptotic ? Is it continually *more slowly* approaching the right line ? I prefer to interline and excerpt rather than expect pure science of good poets.

Browning wrote :

"But God has a few of us whom he whispers in the ear."

and

"He fixed thee 'mid this dance of plastic circumstance,
This Present, thou forsooth, wouldst fain arrest :
Machinery just meant to give the soul its bent," etc.

and finally

"This man decided not to Live but Know.
Bury this man there ? . . .
Leave him—still loftier than the world suspects,
Living and dying."

W. R. WHITNEY.

Schenectady, N.Y., U.S.A.,
March 15.

Physiology and "Vital Force."

By Prof. FRASER HARRIS, M.D., D.Sc.

EFFORTS in the past to account for the mysterious powers and properties of living beings have in the main consisted of bringing in some supra-sensible, immaterial, ultra-cognisable "principle" or "entity" as the *causa causans*. This has been known under different names as time went on, but they have all referred to the same thing—psyche, pneuma, the anima sensitiva of Van Helmont, the life principle of Stahl, the Bildungstrieb of Blumenbach, the vita propria of Bordeu, the vitalis agens of Barthez, the Lebenskraft of Reil, the entelechy of Driesch, the elan vital of Bergson, and the biotic energy of Moore. It is of the essence of vitalism to explain life in terms of the less known, to account for the properties of a living being by the indwelling activity of an entity, agent, or force which, by its very metaphysical nature, is inaccessible to human investigation.

To assert that each organ, tissue, and cell is as truly alive as is the whole organism is not "vitalism," but a correct physiological observation, for the isolated organ—heart or liver—can perform its vital functions long after separation from the body to which it belonged; and the cell taken from its tissue can live for years, as Ross Harrison and Carrel have proved, in its morphological isolation. To say these organs have an independent life (whether it is said in English or in Latin *vita propria*), is to report an observation; to say that life is due to a "life force" or "entelechy" is to state a theory.

If the vitalists had always been careful to admit that their view was only a theory of life, much acrimonious discussion would have been avoided; but when they declared that theirs was the only right view, their virtual claim to omniscience failed to arouse in many minds the enthusiasm expected. These unconvinced people tried to explain life in terms of what they knew at least a little about—the non-living world around them; and they were in consequence called materialists and their theory mechanistic. Now theirs is a theory no less than is the vitalistic. The materialistic theory is that the observed known—the properties and behaviour of living organism—may be explained by applying to them our knowledge of the laws and properties appertaining to the non-living world. It is an explanation of the known in terms of the more known rather than the less.

The term "materialist" ought not to be used as one of reproach; the materialist is almost always a sincere searcher after truth, who, starting from his colleague the physicist's knowledge of the properties and behaviour of non-living matter, attempts to apply these to the behaviour of living matter. He finds that many of the laws that hold good in the world of the non-living seem to be equally applicable to that of life. In particular, he finds that vital heat, for example, is not in its essence different from heat of non-vital origin, that the great generalisation of the conservation of energy holds good for the mammalian body, that "vital" processes are accelerated by a rise, and retarded by a fall, in temperature exactly like "purely" chemical reactions in a test-tube. He is able to say in the language of his chemical colleagues that living matter (protoplasm) behaves in many respects like an irreversible colloidal emulsoid hydrosol.

The materialist found, as a matter of fact, that so many vital activities seemed to be the outcome of the operation of laws already proved true for the non-living universe, that he finally made so bold as to assert—and here he made the first mistake—that the mystery had vanished, and that protoplasm, chemically speaking, was only an excessively complicated form of matter. To this view Loeb committed himself. He wished us to believe that he had proved that the dividing line between the non-living and the living had been removed, and that we might pass by a number of gradations from physico-chemical simplicity at one end of the series to great physico-chemical complexity at the other. Somewhere on the way one passed from the non-living to the living.

Here the materialist went beyond what his premises allowed him; in this he was rash; but rashness inheres in the enthusiasm of youth, and biology is a very young science. But the vitalist had always been rash for exactly the same reason; he had gone beyond experience. He had asserted that urea and sugar could never be made without the agency of life, because he had never found these substances anywhere except in living animal or vegetable tissues. When, therefore, in 1828 Wöhler made urea in a test-tube, and in the 'eighties of last century Fischer synthesised sugars, and when indigo was produced that had never seen a plant, and when the hormone adrenalin was constructed artificially, vitalism received a set-back, and materialism a corresponding encouragement. The anti-vitalistic view was further strengthened by the discovery that many ferments, solely the products of life, dealt with their "substrates" exactly like the inorganic catalysts so well known to chemists. Finally, when Loeb caused the unfertilised eggs of the sea-urchin, either by altering the density or composition of sea-water, to begin to undergo development, the days of vitalism seemed numbered.

The materialist has, indeed, shown us how the plant is able to synthesise a carbohydrate from carbon dioxide and water through the stage of formaldehyde; but he himself is very far indeed from making a scrap of nucleated protoplasm, and until he does that, since we know no life apart from nuclei, it seems exceedingly improbable that he will be able to synthesise any kind of living substance. The materialist goes far beyond his observations when he maintains that the laws of the non-living world are the only laws which operate in the sphere of the living. It is one thing for them to operate there, it is another for them to operate *alone*.

Life and living things are *sui generis*. It is better to admit at once that so far as our experience goes up to this hour, life is unique. Prof. J. A. Thomson gives the following features of the uniqueness of living matter thus (Gifford Lectures, St. Andrews, 1915–16):

1. Its capacity for enregistering experience which, in the hereditary relation, is an expression of physiological inertia.

2. The self-maintaining tendency of the organism.

3. Its variability, or the capacity to give origin to the new.

Living matter can do what no non-living matter can—assimilate material wholly unlike itself; evolve from a minute and relatively homogeneous speck into an obvious and heterogeneous organism; reproduce its kind either by casting off buds or by gametes; pass through a life-cycle of irreversible stages, from infancy to youth, maturity, senescence, and death.

So far as we can judge, the higher animals possess a variety of energy, nerve-energy, which also is *sui generis*. Finally, in the realm of the living we encounter those phenomena called subjective, the world of consciousness with all its modes—sensation, emotion, volition—a world which, so far as we know, never exists apart from living matter, and is absolutely unique.

Certain critical vitalists sometimes blame physiologists for investigating living things by the methods of chemistry and physics. The late Sir James Mackenzie wrote (*British Medical Journal*, March 1, 1924): "Physiologists place the organ in artificial conditions, employ artificial stimulation and obtain artificial results . . . such as the all-or-nothing law."

Now this criticism is rather hard to bear, because we have no methods or apparatus other than these "artificial" ones. Although the biologist is investigating phenomena that are *sui generis*, he has unfortunately no apparatus which is adapted exclusively to biological use. The physiologist uses test-tubes, retorts, induction-coils, and galvanometers because there are no two kinds of instruments, one for biologists, and one for physicists. It is rather hard that, having been forced to use these things and having by so doing obtained results valuable to medicine, he should be stigmatised as a materialist.

When we speak of the mechanism of gastric digestion, we merely use the expression as a conveniently short one for all those processes which are involved in the vital manufacture of pepsin and hydrochloric acid from neutral blood, their separation through and by the mucous membrane, and their solvent action upon food in the interior of the viscus. Nothing more "mechanical" is meant than this, and this is not mechanical at all. Only the last process, the solution of the protein, can go on *in vitro*; only life can manufacture pepsin from blood and an acid from alkaline or neutral salts, and separate these without digesting the wall of the stomach in the very act itself. It is most unfortunate that anything to do with a machine should be mentioned in this connexion.

Because the stomach "works" rhythmically and predictably we may call it a machine for turning out pepsin from blood and liken it to a machine for turning out (say) newspapers, but the secretion of pepsin is not mechanical, nor is the output of newspapers vital. Processes that closely resemble each other are not necessarily identical. In a decerebrated animal the same predictable reflex action can be obtained time after time from the same stimulus, and we may speak of the inevitableness of the mechanism of reflex arcs; but in no other sense is the spinal cord a machine.

Non-vitalistic physiologists are blamed not merely for speaking of organs and organisms as machines but also for daring to study organs and systems by themselves, whereby, it is alleged, they have lost sight of the wonderfully co-ordinated activities of the animal as a whole.

It would seem that the physiologists can never do anything right; at a time when nothing was known of the heart, or of the liver, or of the retina, what else could the investigator do than confine his attention to one thing at a time? Some of us, indeed, are trying to take a comprehensive synthetic outlook over the whole field of vitality, but that could not have been done by the pioneers, who could only push their way slowly into an unknown territory.

One would infer from the obituary notice of the late Sir James Mackenzie in the *Times* (January 27) that physiology is bankrupt. Sir James is quoted as having said: "When this [his own view of physiology] is realised, the whole of the physiological interpretation of the functional activities of organs will have to be scrapped. This is one of the results that I anticipate."

The physiological methods by which were discovered the localisation of cerebral function, reciprocal innervation, the endocrine function of the adrenals, the thyroid gland, and the pituitary, by which insulin was isolated and adrenalin synthesised, cannot be discredited.

The experimental work of Schafer, Bayliss, Starling, Sherrington, Pavlov, MacLeod, and the Hills is not only not to be scrapped, but is also to be recognised as the logical modern basis of practical medicine. The researches that led up to electrocardiography, with which Sir James Mackenzie himself was so conspicuously associated, are another illustration. From some of his expressions the incautious reader might suppose that current physiology was useless as an introduction to medicine, and that the secret of success in diagnosis and treatment consisted in the reinstating of a "vital force." Mackenzie, writing in the *British Medical Journal* (March 1, 1924), thus expressed himself: "The reason for the lack of progress in respect of [knowledge of] living matter has been the absence of a knowledge of a vital force!" The whole tenor of this paper is that we must distrust the results of "artificial" stimulation of tissues because the effects of these are not normal, are not the same as those produced by the "vital force." The experimenter, in fact, comes under a heavy condemnation. We are further told that because we do not better understand pain and why certain reflexes occur, this "vital force" must be postulated.

The term "impulse" plays a large part in this neo-physiology. We are told: "Where a cell discharges its energy in the shape of its peculiar [? particular] function, it at the same time discharges an impulse." We must know, therefore, where in the conceptual scheme of things, which has served physiology so well for the last thirty years, we can place this all-important "impulse."

As regards protoplasm three concepts are fundamental—(*a*) its affectability (irritability), (*b*) the stimulus that may operate upon it, and (*c*) its own response. The behaviour of a living efferent nerve may best illustrate the relations between the members of this biologic trinity. The neuroplasm, in virtue of its possessing the property of responding to a stimulus (affectability), and having received a stimulus, responds

by giving rise to an excited state which travels down the nerve as the impulse to the effector organ at the periphery, say a muscle, which twitches when the impulse impinges on it.

Let us suppose that the stimulus is a blow on the nerve, or a pinching of it, seeing that the electric stimulus of the induction coil was regarded so unfavourably by Mackenzie. Of course the existence of this impulse is an inference from what happens: a nerve receives a blow at one end and a muscle twitches at the other; something must have passed down the nerve, and that something we have for a long time called the impulse. It is said to travel down the nerve by reason of the nerve possessing conductivity.

The other indication that something is passing along the nerve is that if a galvanometer be substituted for the muscle, then when a blow is given to the nerve, the galvanometer records the presence, for a very short time, of an electric disturbance in the nerve. We infer that this electric current is an outward and visible sign of the existence of the invisible nerve-impulse. But just here a very important conclusion is reached, namely, that the impulse in the nerve on arriving at the muscle is for the muscle a stimulus to it to "contract"; the impulse in the living nerve can, then, an instant later, be the stimulus for the living muscle, the response of which is a state of shortening or contraction.

We infer that in the intact animal the nerves are conveying impulses normal or homologous, exactly similar to our laboratory ones, because if a nerve *in situ*, for example the phrenic, is connected to a galvanometer, electric currents in this case also are seen to pass through that instrument. These natural (normal) impulses must be the natural (normal) stimuli for the muscles *in situ*.

All this is very elementary; but it is evidently necessary to restate it because it accounts for everything that Mackenzie observed without calling in the aid of a "vital force" at all. We fail completely to see where and why this force needs to be invoked, and why physiology is bankrupt if it is not so introduced.

If this "vital force" is another name for the nerve-impulse—and it can scarcely be synonymous with either "stimulus" or "response"—then it is a superfluous term. If it is not a synonym for any of the three, then it is some fourth thing for which apparently there is no place in the scheme which has served biology so well in the past. The neo-physiologist may reply: it *is* a synonym for the nerve-impulse, but it comprehends "impulses" in all other tissues. Mackenzie's own words, in a paragraph headed, "The *impulse* a *vital force*," were: "An impulse is the product of cell-activity, it can only be conveyed by living structures and acts by stimulating cells to discharge their function . . . it differs from all other forces."

If the impulse in this passage be confined to *nerve*-impulse, no fault can be found with it, for the nerve-impulse is the product of (nerve) cell activity, it can be conveyed only by the living structures of the nerve, it acts by stimulating (muscle) cells to discharge their function (of shortening), and it differs from all other forces in that, as a nerve-impulse, it is *sui generis*. But why declare that unless we call this impulse a "vital force," physiology is to be discredited ("scrapped").

We do not need an additional name for the nerve-impulse; if we are forced to give it a new name, why give it one so redolent of obscurantist animism (*loc. cit.*)?

It is, however, quite clear that by "impulse" Mackenzie meant something that was active in all the tissues, for he speaks of *cells* in the widest sense. Now what are these impulses in tissues other than neural? What impulses are there in muscle, connective tissue, gland, fat, bone? In muscle we have states of contraction; and we can *call* them "impulses" if that will rescue physiology from the scrap-heap, but one fails to see what is gained thereby. As for "impulses" in connective tissue, fat, or bone, we have no evidence of them. In glands, doubtless, some states of excitation can travel (slowly) along, but again we see no benefit from calling them "impulses."

It is difficult to see, therefore, why physiology is to be declared as proceeding on a totally wrong road. It may be frankly admitted that there is in physiology more than is dreamed of by the mechanistic philosophy. The laws of matter that has never lived have failed so far to account for certain facts, for example, about absorption both from intestine and bladder, and for certain facts about urinary secretion. It has been shown that living membranes act very differently from dead ones.

The materialistic view of life has failed signally to account for certain realities of our experience of which consciousness is the group name. Huxley himself made his bow to consciousness and waved it away as an epi-phenomenon. For the materialist, consciousness cannot be a cause of neural activity; nor can states of body affect mind, for mind is an illusion. The mechanistic theories are incapable of throwing any light on the central fact of experience, the permanence of personality amid the flux of matter.

Prof. Haldane has well said that "living" and "mind" are not reducible to simpler terms; they are the axioms of biology; and this thinker firmly believes that physiology is being retarded by mechanistic conceptions which deprive us of a complete view of life. As Prof. J. A. Thomson has said:[1] "We need new concepts such as that of the organism as a historic being which has traded with time." "We need these new concepts because there are new facts to describe, which we cannot analyse away into so-called simpler processes."

The most reasonable position to assume as regards vitalism is to insist that there is no compulsion for the biologist to be either a materialist or a vitalist. It is quite open to him to say that as he is dealing with an order of things that is unique, with existences that are *sui generis*, and that as his science is so young, he is not yet in a position to dogmatise and declare that *qua* life there are no categories beyond those the physicists and the chemists recognise.

Of all the many wise things Prof. Thomson said in his Gifford Lectures at St. Andrews (*loc. cit.* vol. 2, p. 147), this is surely one of the wisest: "We regard the question as one of the many *false dichotomies* with which man in his search for clearness has been led astray."

[1] "System of Animate Nature" (Williams and Norgate, vol. 2, p. 160).

The German Museum of Science and Technology.

THE new building of the Deutsches Museum at Munich is to be opened on May 7, which is the seventieth birthday of its founder, Dr. Oscar von Miller. A short account of this great museum will therefore be of general interest.

In NATURE of September 17, 1908, there appeared an account of the conception and foundation of the Museum, with a description of the collections then housed provisionally in the old National Museum building in Maximilian-strasse. Only five years before this, Dr. Oscar von Miller had laid his plan for a great national science museum before a small circle of men of science, technologists, and representatives of the German Government and of the city of Munich. The idea was taken up with enthusiasm, and very fine collections were quickly brought together and arranged in the above building, which was opened to the public on November 13, 1906. On the same day the foundation stone of the permanent new building was laid by the German Emperor, the Prince Regent, and Prince Ludwig of Bavaria. The site for this building had been granted by the city of Munich, and on October 20, 1906, the design of the architect Prof. Gabriel von Seidl had been selected from the thirty-one competitive designs which had been submitted. This site, an island in the river Isar, is shown in Fig. 1.

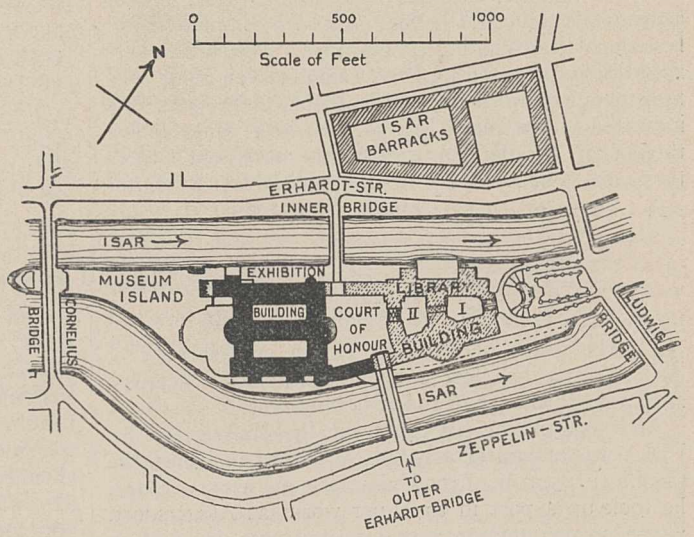

FIG. 1.—Sketch plan of the Deutsches Museum, Munich. The portion completed and occupied is blackened in. The old National Museum is less than half a mile to the north.

The rapid increase in the number of acquisitions to the collections soon made it necessary to seek accommodation additional to that provided by the old National Museum. For this purpose the rooms of the old dragoon barracks on the north-west bank of the Isar were utilised, and these were opened to the public on January 1, 1909.

The new building, in accordance with the scheme laid down by the museum directorate, was planned in two main groups, as shown in Fig. 1, namely, the Exhibition building, and the Library building. The former was to house the unique exhibits already acquired, and to be on a scale sufficiently large to allow for ample expansion and development of the collections. The latter was to contain the collections of early and modern scientific and technical books, manuscripts, drawings, etc., as well as to provide workshops, laboratories, lecture-rooms, conference halls, etc.

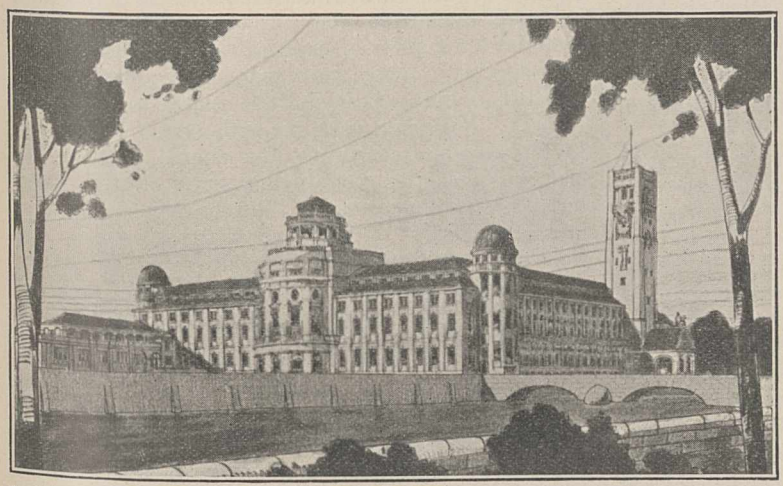

FIG. 2.—The Deutsches Museum, Munich. The exhibition building completed: view looking south.

By the summer of 1914 the skeleton of the exhibition portion of the museum building had been completed, and it was then anticipated that the building would be open to the public by 1916. Building operations, however, were protracted by the War, but in spite of many difficulties, progress, though slow, has since been maintained steadily, and this portion of the Museum (shown in Fig. 2) is now ready to be opened. In September 1914, the old Isar barracks being required for war purposes, the collections therein had to be stored away. By September 1922 certain of the rooms in the old National Museum were closed, and the work of transferring the collections to the new building was commenced. On September 18, 1923, the whole of the old building was closed to allow of the systematic transference of the rest of the collections.

The characteristics and attractiveness of the collections, even when housed in their temporary buildings, were referred to in NATURE in 1908. These features rested not only in the valuable exhibits themselves, but in the unique method of presentation, which aimed at giving the whole nation, student and layman alike, but particularly the young, an insight into and review of scientific and technical conceptions and inventions, with the human aspect carefully interwoven. The provision of this magnificent new Museum has allowed these

features to be developed in an enhanced degree, and the result is one of which the German nation may well feel proud.

With regard to the library building, the construction of which has still to be carried out, the original design of Prof. G. von Seidl was at an early stage found to be quite inadequate. The number of bequests and promises of books, drawings, plans, films, phonograms, etc., so exceeded original expectations that proper accommodation could be met only by a complete modification of the building programme. New plans were accordingly prepared by Prof. Emanuel von Seidl, who took over the work on the death of his brother. As indicated in the plan (Fig. 1), two long wings follow the lie of the land towards the north-east, where they are connected by a frontage facing a monumental approach leading from the Ludwig bridge. These wings are further connected with each other by two transverse buildings. From the approach court a passage leads to Court I., another to Court II., and a third leads to a large impressive Court of Honour, on the opposite side of which is the chief entrance to the exhibition building. This Court is also directly accessible from both sides of the river by means of the Erhardt bridges. The library building will be provided with four floors above the ground-floor and basement, except in the two low wings by which it is connected to the exhibition building.

Amongst the many objects specially designed or acquired for the new building are the two giant planetaria, one of which was described in NATURE of December 27, 1924.

Obituary.

DR. CARL ULRICH.

BY the death of Dr. Carl Ulrich on February 9, Austria has lost one of its foremost chemists, and radio-chemistry one of its pioneers.

After completing his course at the University, Dr. Ulrich was appointed assistant to Hofrat Lieben in the Chemical Institute of the University of Vienna. Later, he took up a post in the Auer works at Atzgersdorf, where, in conjunction with Dr. Haitinger, he made a study of the working up of pitchblende on a large scale. He was largely responsible for the organisation and equipment of the radium works at Joachimstal in Bohemia, the management of which he took over in 1910. Here he laboured until the close of the War, when the radium works passed into the hands of the Czecho-Slovakian Government, and Dr. Ulrich, being of Austro-German nationality, had to resign his post. During the next few years he acted as adviser to the Ministry of Trade in Vienna, but was pensioned off two years ago. Since 1918 he had been engaged on radio-active work in the Vienna Radium Institute.

Dr. Ulrich always showed a keen and active interest in the work of the Radium Institute, and he was ever ready to give it the benefit of his ripe experience in the varied chemical problems that arose from time to time. Many of the tertiary radium standards to be found in various parts of the world are primarily the work of his hands, and they provide an appropriate memorial to his labours. He died of sarcoma of the lungs, which, in the opinion of his medical advisers, was a direct result of his long-continued manipulation of large quantities of radium. It is a significant fact, however, that Dr. Ulrich had not worked with radium in quantity since he left Joachimsthal in 1918.

Dr. Ulrich was keenly interested in the development of the science of isotopy, and some of the earliest work on the isotopes of lead and thorium was performed with material supplied or rendered accessible by his intervention. To the world of science in general, and to his Austrian colleagues and friends in particular, the death of Dr. Ulrich means a great loss.

ROBERT W. LAWSON.

THE death occurred on December 19 last of Prof. H. L. Wells, and we are indebted to the *American Journal of Science* for the following details of his life and scientific career. Horace Lemuel Wells was born on October 5, 1855, in New Britain, Connecticut, and went to Yale University in 1884 as instructor in analytical chemistry in the Sheffield Scientific School, and eventually was appointed professor of analytical chemistry and metallurgy. This post he held from 1893 until 1923, when he was made professor emeritus. Prof. Wells devoted much attention to the analysis of minerals; he determined the composition of a number of minerals from Branchville, described with E. S. Dana the new mineral beryllonite, and analysed a new platinum mineral which he called sperrylite. In 1891 he obtained a supply of the rare mineral pollucite from which a quantity of cæsium salts, hitherto only known in small quantities, was extracted. This furnished material for a series of investigations on cæsium compounds which covered more than thirty years. About one-half of his published work relates to these substances. Beginning with the perhalides of cæsium, he investigated systematically the double salts of this element, and later discovered a series of triple salts, notably triple thiocyanates. In 1897 Prof. Wells translated Fresenius's "Qualitative Analysis," and he also published works on chemical calculations. In 1904 he became an associate-editor of the *American Journal of Science*. He was elected a member of the National Academy of Sciences in 1903.

WE regret to announce the following deaths:

Mr. S. R. O. Dudfield, hon. foreign secretary, Royal Statistical Society, past president of the Harveian Society, London, and for thirty years medical officer of health for Paddington, on April 19, aged sixty-four.

Sir Rickman John Godlee, Bart., K.C.V.O., hon. surgeon in ordinary to the King and a past president of the Royal College of Surgeons, on April 20, aged seventy-six.

Sir David Lionel Goldsmid-Stern-Salomons, Bart., vice-president and treasurer for many years of the Institution of Electrical Engineers, on April 19, aged seventy-three.

Current Topics and Events.

SAMUEL F. B. MORSE, of Charlestown, Massachusetts, inventor of the Morse electro-magnetic recording telegraph, was born on April 27, 1791. He died a little more than half a century ago. That Faraday was born also in the same year is an interesting coincidence. The latter, lecturing at the Royal Institution in 1858, said: "Thoughts of an electric telegraph came over the minds of those who had been instructed in the nature of electricity, as soon as the conduction of that power through metals was known." Prof. Morse himself declared that he had "a distinct recollection of the manner, the place, and moment when the thought of making an electric wire the means of communicating intelligence came into my mind and was uttered." He was referring to the year 1832, and specially recalling an experience when a passenger on the *Sully*, a boat plying between Havre and New York. The construction and practicability of apparatus for the purpose in view occupied many anxious years. Morse held that such an invention would mark an era in human civilisation and contribute to the happiness of millions. For long he worked in penury. At last, in March 1843, Congress voted 30,000 dollars for definite experimental projects in connexion with the invention. In May, the following year, success in actual service was achieved. The message, "What hath God wrought," was sent from the Capitol at Washington to Baltimore, Morse operating the transmitter. It is of interest to add that at the Oxford meeting of the British Association in 1847, Sir Robert Inglis, the president, referred to the rapid progress of telegraphy in the United States as the immediate outcome of Morse's work, and alluded with regret to the circumstance that in England this great discovery had been, so far, inadequately adopted.

DR. HENRY FAIRFIELD OSBORN has issued his presidential summary of the work of the American Museum of Natural History during 1924 in advance of the main report. He entitles it "The American Museum and Education," and contrasts the education by means of this (or any properly organised) museum with that of the school and the university, comparing it with that direct teaching through Nature which was the privilege of boys and girls in the Stone Age. That severe but inspiring approach to the duties and pleasures of life has been smothered under cities, lectures, books, and newspapers. Museum teaching should aim at restoring that immediate vision, and should regard "books and learning as the handmaids and not the masters of education." Dr. Osborn passes on to acknowledge the help received by the American Museum. Although a private institution, the museum manages to secure every possible aid from the United States government in its foreign relations. Consequently its expeditions meet with the cordial assistance of viceroys, governors, ministers, and government officials in the numerous foreign countries explored. Foreign sportsmen also, realising the value of the museum's work, readily place their skill and experience at its disposal. We are far from grudging the help that is here so cordially acknowledged, but we should like to see more of the same assistance given by British governments to British expeditions.

GOVERNMENTS, no doubt, help those that help themselves. This it is that has been the merit of the American Museum of Natural History. Beginning with endowments and financial assistance from a few rich men, it now rests largely on the usual subscriptions of 7952 regular members. The average annual contribution from the City of New York amounts to little more than one-third of the whole. Would it not be possible for the Natural History Museum at South Kensington to obtain similar support? The National Art Collections Fund proves that even government institutions need, and can receive, private help. We in Great Britain need not be ashamed to follow the example of the American Museum of Natural History.

ON Friday, April 18, Dr. Fournier d'Albe gave a private demonstration of his television apparatus at his laboratory at Kingston-on-Thames. The apparatus shown represented a further stage in the simultaneous transmission of several elements of a picture by allocating different audio-frequencies to different elements. An image of the object to be transmitted was projected on a revolving siren disc provided with thirty concentric circles of holes. An image of the disc was, in turn, projected on a transmitting screen studded with thirty small selenium tablets, arranged so that each tablet was exposed to a different audio-frequency of intermittent light produced by the disc. The selenium tablets were connected in parallel with a two-valve amplifier, and the sound produced in a loud speaker at the receiving station was allowed to act upon thirty compound resonators, each of which responded to its own note when it occurred in the medley of sound transmitted. The response manifested itself by the appearance of a luminous patch on a ground-glass screen, reproducing an element of the original object both as to position and intensity. As the response occurs within a twentieth of a second, it is claimed that the apparatus transmits some six hundred signals per second. As, however, the complete transmission of an object such as a changing face requires at least ten thousand signals per second, there is still a considerable gap to be filled. Dr. Fournier d'Albe hopes to do this by increasing the number of resonators and their selectivity, or, in the last resort, by transmitting over more than one wire or on more than one radio-wave-length.

EXCAVATIONS at Ur during the final month of the season have brought to light a remarkable stele which Mr. C. L. Woolley, writing in the *Times* of April 15 and 16, regards as the most important monument yet found on the site. As an example of Sumerian art, it ranks with the famous Stele of the Vultures now in the Louvre. The reliefs on this stele among other subjects show Ur-Engur, the

founder of the Third Dynasty and the builder of the ziggurat, actually engaged in its construction. Two series of clay tablets have been found, one dating from 2200 B.C., the other from 2000 B.C., which give an intimate picture of the economic organisation of the temple with its establishment of ministers and court officials, additional to the priests, each in charge of a department—war, justice, lands, the household, the harem, etc. The tablets show in detail the receipts from tithes and rents or shares in the produce of the lands, while monthly balance sheets give the amounts received in kind from each farmer as well as the townsman, the latter paying in hides, gold, silver, copper, and other commodities. A strict account of the outgoings shows the rations issued to each of the numerous inmates of the temple and its precincts. These included a large number of women devotees who worked in factories, chiefly at weaving. The amount of wool thread issued to these and to the piece-workers, who occupied workshops outside the walls, is recorded with the quantity and quality of material it produced in each case. The food paid as wages was proportionate to work done, and children and old women received less than the young women. Temple officials when travelling held letters of credit which enabled them to obtain food in the cities through which they passed.

THE first of the series of lectures on "Illuminating Engineering," arranged under the auspices of the Illuminating Engineering Society at the Polytechnic, was given on Monday, April 20, when Mr. J. W. T. Walsh of the National Physical Laboratory delivered an address on "The Nature of Light and its Measurement." After a short introductory sketch of the development of the illuminating engineering movement, Mr. Walsh explained the chief terms used in dealing with illumination, processes in the photometric laboratory, and the use of portable illumination photometers, several examples of which were exhibited and examined after the lecture. There was a representative audience, including members of the staff of firms in the lighting industry and several of the lecturers responsible for subsequent items in the course. The organisation of a course of this nature, reviewing progress in various aspects of illumination, is a good idea which might be taken up by other educational institutions. It is particularly desirable that representatives of firms commercially concerned with illumination should have opportunities of hearing an impartial and scientific review of the problems with which they are concerned and of obtaining the latest information from specialists on various aspects of the subject.

IN a lecture delivered before the Royal Institute of British Architects on April 20, Mr. P. J. Waldram discussed the natural and artificial lighting of buildings. Mr. Waldram reviewed problems involved in determining access of daylight into buildings, on which he is an expert, but artificial lighting was not dealt with in detail. The paper, however, dealt with several suggestive points, especially in connexion with comparisons between natural and artificial light. Mr. Waldram apparently thinks that a considerably higher illumination is necessary for most processes in the case of artificial light than is necessary by daylight, but this view was disputed by several speakers in the course of the discussion. This seems to be a question on which further study is needed, and it is somewhat surprising that such a fundamental point should still be a matter of doubt. In view of the effect on the eye of an overhead sky of considerable brightness, and the presence of adjacent objects in general far brighter than those usually encountered by artificial light, one has the impression that the eye is accustomed to a range of illuminations by daylight much in excess of that afforded by artificial means.

IN his presidential address to the Ipswich and District Natural History Society, Mr. J. Reid Moir, as reported in the *East Anglian Times* of April 2, surveyed the archæology of Ipswich from Pliocene to Anglo-Saxon times. The evidence of the fossils of the Red Crag, indicating a gradual lowering of the temperature, together with the occurrence of striated flints and far travelled rocks in the underlying detritus bed, suggests that the crag was laid down in the first glacial period of East Anglia. The Cromer Forest Bed of Norfolk is not represented at Ipswich, but a series of gravels rest upon the Red Crag in which are implements, of Early Chellean Age in most cases, evidently derived from some older deposit. It is possible that this deposit was of Cromer Forest Bed age. The Tills and Contorted Drift of Norfolk overlying the Cromer Forest Bed are probably represented at Ipswich by the Kimmeridge Boulder Clay belonging to the second glacial period of East Anglia. The receding ice left hollows, often of considerable depth, such as the Foxhall Road Site, which contain in the brick earth and gravel filling hand axes of Acheulean and Mousterian types. The glacial deposits overlying the brick earths represented the third glacial epoch of East Anglia. The Upper Chelky Boulder Clay contains Mousterian implements torn from the brick earths by the ice. In a following period of climatic improvement, Upper Mousterian man inhabited the area, followed by Aurignacian man, whose occupation level was on the surface of a layer of stoneless loamy sand. This period was sealed in by a deposit of hill-wash, the result of a lowering of temperature, in which Solutrean implements had been found.

FOR several years past a Synonym Committee, working at first in connexion with the Ministry of Agriculture and later with the National Institute of Agricultural Botany at Cambridge, has been endeavouring to reduce the confusion which exists in respect of the names of potato varieties and their synonyms. The results of the investigations have been embodied in a pamphlet which includes information concerning varieties that have been definitely tested in regard to their susceptibility to wart disease. Most of the tests for immunity were carried out at Ormskirk, but some were conducted by the Scottish Board of Agriculture. Two years' freedom from wart is officially required to establish immunity, and the

list includes as immune only such varieties as have been unaffected by wart disease in at least two seasons' tests, though a single test is sufficient to brand a susceptible variety. Two lists are given, one of distinct varieties, in which case the immunity or otherwise is recorded, the other of synonyms, in which reference is made to the distinct variety of which the synonym is but another name. While acknowledging assistance received in the compilation of the lists, the Synonym Committee accepts full responsibility for the publication and for the inclusion or otherwise of any given name.

REFERRING to our note (NATURE, April 11, p. 545) on Prof. R. Hamer's suggestion to name the undiscovered element of atomic number 43 "moseleyum," after H. G. J. Moseley, Prof. Irvine Masson writes that such action would not, as stated, be an innovation, as "one element *is* named after an individual: namely, Gadolinium, a rare-earth element, called after Gadolin." The historical facts appear to be as follows. The mineral gadolinite, discovered in 1788, was named after the Finnish chemist Johann Gadolin, who in 1794 discovered a new earth—yttria—in it. About a century later, Marignac showed that yttria (which he had obtained from samarskite) contained a new element, and when Lecoq de Boisbaudran announced to the Paris Academy of Sciences that Marignac had chosen for it the name "gadolinium," he gave no reason for the selection (*Comptes rendus*, 1886, p. 902). The case of the element samarium is somewhat similar. The complex parent mineral samarskite was, apparently, named after a Russian mine officer, Samarski. When the existence of the element was proved, Lecoq de Boisbaudran told the Academy that the honour of its discovery really belonged to several investigators, and he proposed the name "samarium" because the word was "derivé de la racine qui a déjà servi à former le mot 'samarskite'" (*Comptes rendus*, 1879, p. 214). Whether the words "gadolinium" and "samarium" were derived directly, or indirectly, from the names of men or minerals appears of little moment; both perpetuate the names of individuals, and therefore, in this sense, the appellation "moseleyum" would have two precedents.

A MEMORANDUM, addressed to the Council of the Industrial Institute, 102 Belgrave Road, London, S.W.1, has been issued suggesting an inquiry into "Balanced Industrial Development." The objects outlined include the promotion of scientific research and its organised application to industry, the strengthening of the foundation of industrial ethics, the formation of a clearing house for the collection and diffusion of information on all questions of industrial relations, and the examination of legislative and other proposals affecting industrial relations. The recently formed Industrial Institute is essentially non-political and it receives influential support from eminent representatives of both labour and capital, scientific and industrial bodies. It is hoped that the co-operation it affords will promote not only a better recognition of the value of science to industry, but the viewing of controversial questions in a more impartial and scientific spirit. The memorandum suggests the appointment of a special committee of the Institute to investigate all such problems.

THE eighth of the public lectures on "Physics in Industry" being delivered under the auspices of the Institute of Physics will deal with "Physics in the Rubber Industry with special Reference to Tyre Manufacture." The lecture will be given by Dr. W. Makower in the rooms of the Royal Society, Burlington House, London, on Wednesday, April 29, at 5.30 P.M.

THE summer meeting of the Institution of Electrical Engineers will be held this year at Birmingham on June 9-12. As three hundred members and their ladies have already sent in their names, others wishing to take part are advised to send their applications without delay to the Secretary of the Institution, Savoy Place, Victoria Embankment, London, W.C.2.

THE Council of the Royal Statistical Society will, in 1925, a gain award the Frances Wood Memorial Prize value 30*l*. The prize will, as before, be awarded for the best investigation received not later than October 26, of any problem dealing with the economic or social conditions of the wage-earning classes, the subject to be treated on statistical lines. Particulars can be obtained from the honorary secretaries of the Royal Statistical Society, 9 Adelphi Terrace, W.C.2.

THE Coopers Hill War Memorial Prize, founded by members of the Royal Indian Engineering College, Coopers Hill, in commemoration of members of the College who fell during the War, is awarded annually by the Institution of Civil Engineers and triennially in turn by the Institution of Electrical Engineers, the School of Military Engineering, Chatham, and the School of Forestry, Oxford. The triennial award will be made this year by the Council of the Institution of Electrical Engineers for a paper on "The Applications of Electricity to Metalliferous Mining." Papers should reach the Secretary of the Institution not later than October 31.

A BILL has recently been passed by Congress, by which the United States Coast and Geodetic Survey is "authorised to make investigations and reports in seismology, including such investigations as have been heretofore performed by the Weather Bureau." In at first placing such work under the Bureau, the United States Government followed the example of other countries, for example, of Italy, where, since 1887, the system of earthquake stations has been under the control of the Central Meteorological Office. The advantage of the change in the United States is obvious, for the Coast and Geodetic Survey may at any time, as in 1906, be called on to measure the crustal deformations in the central district of a great earthquake.

THE highly successful conference held at Hoddesdon in September 1924, on Special Libraries and Information Bureaux, has resulted in financial support being obtained from the Carnegie United Kingdom Trustees for a period of two years in order to give the new movement an opportunity of becoming self-supporting.

Mr. G. W. Keeling has been appointed organising secretary to the committee which was formed during the conference to ensure the continued co-operation of the interests there represented. Active arrangements are being made for the holding of a second week-end conference at the end of September of this year, and for the preparation of a directory of special libraries and information bureaux for the United Kingdom.

THE gold medal of the Institution of Mining and Metallurgy has been awarded to Dr. Richard Pearce in recognition of his lifelong services in the advancement of metallurgical science and practice. Dr. Pearce was for many years engaged in metallurgical work in the United States, and since his return to England has been associated with the tin-smelting industry. The Council of the Institution has awarded "The Consolidated Gold Fields of South Africa" premium of forty guineas to Mr. Thomas Pryor, for his paper on "The Underground Geology of the Kolar Gold Field," and the "Arthur C. Claudet" and "William Frecheville" students prizes of ten guineas each to Mr. F. H. Edwards (Birmingham) and Mr. D. W. Bishopp, respectively

THE National Academy of Sciences having approved the recommendation of the Committee on Award of the Daniel Giraud Elliot Medal for 1924, the medal and honorarium will be presented at the April meeting of the Academy to Abbé Henri Breuil for his work, in collaboration with MM. Capitan and Peyrony, on the volume "Les Combarelles des Eyzies," as the most outstanding contribution of 1924 in this field. Henri Breuil is the foremost living authority on the archæology of the Old Stone Age. His chief contributions are the recognition of the great Aurignacian upper palæolithic stage and the monographing of the entire Stone Age art of France and Spain. He is a man of untiring endeavour, great personal courage, and deliberate and philosophic interpretative powers. He is the head of the Institut de Paléontologie Humaine, which was founded by the late Prince of Monaco. This is the eighth award of the Daniel Giraud Elliot Medal.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned: junior assistants at the National Physical Laboratory—The Director, National Physical Laboratory, Teddington (May 9); Superintendent of a Government Research Establishment in Lancashire—"S.U.," c/o Chas. Barker and Sons, Ltd., 31 Budge Row, E.C.4; a junior lecturer in science at the Royal Military Academy, Woolwich—The Under-Secretary of State, the War Office (S.D.3), Whitehall, S.W.1 (May 30).

Our Astronomical Column.

THE BRILLIANT FIREBALL OF EASTER SUNDAY.—Mr. W. F. Denning writes: On the evening of Easter Sunday, April 12, at 21h 40m G.M.T., a fireball of large size and dazzling brilliancy was seen by hundreds of observers in the south-west of England. A great number of descriptions have been received from spectators in Cornwall, Devon, Somerset, Pembroke, Glamorgan, and other places. According to most of the estimates, the fireball moved rather slowly and passed over the sea between Cornwall and Pembroke. It concluded its path when about twenty-five miles west-north-west of Strumble Head, near Fishguard. The fireball may have fallen into the sea when it had traversed another twenty-five miles, but it is doubtful if it survived, and no reports have come in that it was actually seen to fall.

The object was one of the most brilliant that has appeared in recent years. The illumination of the atmosphere and landscape which it occasioned just before its disappearance was remarkably vivid and startled many observers. Two or three minutes afterwards a deafening noise, like a double explosion, was heard at Fishguard, and at other places in the neighbourhood.

The nucleus of the fireball is described as emitting a steel-blue colour, and it left a broad train of fiery sparks in its wake, but this vanished immediately. During its visible course the object descended from about sixty-nine to twenty-two miles at a very moderate speed, and was directed from a radiant point in Virgo, but the exact position of this is not defined by the observations available at the present time.

COMETS.—The three comets (Schain, Reid, and Orkisz) have all been observed recently in England. The two latter are fairly bright, about magnitude seven, but Reid's is getting too low for easy observation here.

Mr. Orkisz discovered his comet at the small observatory on the summit of Mt. Lusina in Poland, a few miles south of Krakow. It is rapidly moving north and will soon become circumpolar.

Mr. G. Merton (B.A.A. circular No. 5) has computed the following orbit from a combination of ten observations extending from April 5 to 14:

T	1925 April 1·2904 G.M.T. (new)	
ω	35° 55′ 17·3″	1925·0
Ω	318 1 25·3	
i	99 57 22·6	
log q	0·045126	

EPHEMERIS FOR 0h G.M.T.

	R. A.	N. Decl.	log r.	log Δ.
Apr. 25	22h 51m 35s	40° 13′	0·070	0·180
May 3	23 7 31	51 5	0·087	0·170
,, 11	23 31 53	62 2	0·108	0·172
,, 19	0 17 14	72 17	0·130	0·185

In May the comet will be observable throughout the night.

Schain's comet is still a difficult object, of about magnitude eleven. It is receding from the earth, and this more than offsets its slight approach to the sun. Perihelion passage will probably be about August, and the perihelion distance promises to exceed that of any known comet, being apparently somewhat greater than that of the comet of 1729 (4·05 astronomical units) which has held the record until now. The orbit was an extremely difficult one to compute from the early observations, and the dates found for perihelion passage ranged from November 1924 to February 1926.

The following approximate ephemeris should suffice for finding the comet:

	R. A.	N. Decl.
Apr. 28	10h 50m	4° 3′
May 6	10 41	4 17
,, 14	10 32	4 27

Research Items.

RACIAL PSYCHOLOGY IN THE UNITED STATES.—The population problem and, in particular, the colour question in the United States, which has produced much dogmatic but unsubstantiated assertion, has had a beneficial effect in leading to an examination of records for exact data which may bear upon the question of mental racial differences. In the *Scientific Monthly* for March, Dr. Bertha M. Luckey of Cleveland, Ohio, a city which contains a large percentage of foreign-born adults, has analysed the results of tests of school children for intelligence. As the data were obtained from the clinic, the majority of the children were super- or subnormal. Figures are shown for ten nationalities. The highest percentage of subnormal children is shown by the Negro and Polish groups (65 per cent.), and the lowest by the Jewish (29 per cent.), the intermediate order being Slavish, Slovenian, Italian, Hungarian, German, Bohemian, and American (30 per cent.). The largest percentage of bright or unusually bright occurred among the Jewish (24 per cent.), the remaining groups being in the following order: American, German, Bohemian, Slovenian, Hungarian, Slavish, then Polish, and Negro, each 1 per cent., and Italian, 0·5 per cent. Yet in the class "imbecile" the Jewish and American groups had more than the Negro and Slovenian groups. Another paper in the same issue, by the Rev. J. E. Gregg, compares the academic results of students admitted to the Hamilton Institute over a number of years, beginning in 1901. Seven grades of colour, ranging from black to "no trace of colour," have been recorded, but the scholastic results show little difference between the colour groups. Of the twenty-one best scholars of the graduating classes in eleven years (1914–24), the percentages are as follows: Dark brown, 28·5; brown, 28·5; light brown, 28·5; light, 14·2. Of the entrants in 1901–10, the three groups dark brown, brown, and light brown formed 82·3 per cent.

THE COUSIN IN VEDIC RITUAL.—In the *Indian Antiquary* for January, Mr. A. M. Hocart has an interesting suggestion to offer as to the interpretation of the word *Bhratrvya*, which occurs in a formula indicating that the Vedic sacrifice was a victory over evil powers opposed to the sacrificer. The formula is translated "slaying his wicked spiteful enemy." The word *Bhratrvya*, "enemy," is doubtful, but appears to indicate relationship, possibly "cousin." It is suggested that it may bear the meaning more specifically of mother's brother's son, *i.e.* cross cousin. It would then be a case of the ceremonial hostility of cross cousins. There is no direct evidence which supports the suggested meaning of the word; but it is possible that the Vedic relationship system was classificatory and would therefore as elsewhere give rise to cross-cousin hostility. Further, from both Fiji and South Africa there is evidence that the cross cousin in the cases of ceremonial hostility is a representative of the gods. The hostility is not real or infused with hatred. The cross cousin may be identified with the demons through some conception such as is indicated in the story that Namuci, the demon, stole Indra's vigour, the essence of his food. The cross cousin may therefore eat the sacrifice, or part of it, taking upon himself the evil and acting as scape-goat; as such he is reviled and despised, and in Fiji and South Africa, driven away.

POLYEMBRYONY IN PLATYGASTER.—The remarkable phenomenon of polyembryony is now known to be a constant feature in the development of certain minute species of parasitic Hymenoptera. In the *Journal of Agricultural Research*, vol. 28, No. 8, 1924, Messrs. R. W. Leiby and C. C. Hill describe the polyembryonic development of *Platygaster vernalis* in the larva of the Hessian fly. The egg of the Platygaster is so placed in the egg of the Hessian fly that it is eventually found in the mid-intestine of the host embryo or young larva, with unfailing regularity. Each egg of the parasite gives rise to about eight embryos, all of which it is believed are of the same sex. In the course of maturation two polar bodies are formed, which become the original paranuclear masses, while the cleavage nucleus becomes the progenitor of the embryos. The latter are surrounded by a membrane, or trophamnion, which is formed from the paranuclear masses, and when the larvæ are ready to issue, they rupture the trophamnion, thus becoming liberated into the host's intestine. The larvæ eventually consume the whole of the contents of the Hessian fly larva, leaving only the cuticula. Each parasite constructs a cocoon within which it transforms into a pupa and later into an imago. Although the parasites which issue from one host are usually of the same sex, it is believed that the occasional mixed broods that are met with originate from a fertilised and an unfertilised egg deposited in the same individual egg of the host.

PLEISTOCENE FOSSILS FROM SAN PEDRO, CALIFORNIA.—From a cutting through Nob Hill, at San Pedro, California, exposing beds of the Lower San Pedro Series of the Pleistocene, Mr. T. S. Oldroyd obtained from the deposit some 242 species of Mollusca (Proc. U.S. Nat. Mus., 65, art. 22). At the close of this period when the climate of California began to get warmer, the majority of these molluscs migrated north, some 115 being found to-day in Puget Sound; or they sought the cold waters of a greater depth, for there seems to be a trail of the northern molluscs in about 100 fath. all along the coast as far as Lower California; whilst a few accustomed themselves to the change and are found living now near San Pedro. With the exception of two land and two freshwater snails, doubtless washed down into the deposit, the mollusca are all marine, and the author is able to append to his list the descriptions and figures of 20 new species and two new subspecies, mostly small forms. Some crab remains were identified by Miss Rathbun, and the list of these and a few other invertebrates is included in the paper.

ICE IN THE ARCTIC SEAS IN 1924.—The annual report of the Danish Meteorological Institute (Isforholdene i de Arktiske Have, 1924) is fuller than usual, especially as regards the Kara and Barents Seas and the east coast of Greenland, but, owing to lack of information, is very meagre concerning the Beaufort Sea and coasts of eastern Siberia. In European Arctic regions the year on the whole was marked by less ice than is the rule during spring and summer. In August and September the Kara Sea was exceptionally free from ice. The White Sea was clear in June and in the autumn froze much later than usual. In the north-eastern part of the Barents Sea there was more open water than usual; in August, the only month for which there are data, it came very near to Franz Josef Land. During April and May very heavy pack extended to the south-west of Spitsbergen so far south as Bear Island, but the northern part of the west coast, as usual, was clear. In June conditions changed completely, resulting in a summer with exceptionally little ice

in Spitsbergen waters. A Norwegian sloop circumnavigated North-East Land during August. On the east coast of Greenland the few observations suggest a narrower belt of close pack-ice than usual. Iceland was touched by pack-ice only during February. The Newfoundland Banks had little ice and few icebergs, and Davis Strait was fairly clear. The report is illustrated with several maps.

ISOSTASY AND GEOLOGY.—A valuable paper on "The Geological Implications of the Doctrine of Isostasy," by A. C. Lawson, appears as Bulletin No. 46 of the National Research Council (Washington, June 1924). It is pointed out that in considering the transfer of matter from one portion of the earth's surface to another, it is often necessary to recognise that the newly loaded area may be widely separated from the source of the load. In such a case the loaded region and the surrounding territory cannot be balanced with the rest of the earth's crust by merely local flow; a general plastic deformation of the geoid then appears to be necessary to establish isostatic equilibrium. Continental glaciers, epicontinental seas, and large deltas are discussed as examples in which local deep-seated compensation fails to restore a world-wide balance. In the case of plateau lavas, it is not clear to what extent there is a real transfer in the horizontal as opposed to the vertical sense. Mountain ranges are considered both with and without a downward protuberance, and the discussion clearly supports the view that ranges are supported by flotation due to a downward concentration of lighter rock immersed in heavier rock. It is suggested that oceanic deeps may be due to a stretching and thinning of the lighter upper part of the crust accompanied by an upward sag of the heavier sub-crustal matter. The process recalls the mechanism of Wegener's displacement hypothesis, and like it involves great tensional stresses due to the flowing of the crust down a low gradient. As Lambert and Jeffreys have independently shown, no adequate cause for such a process can be imagined in harmony with our observational knowledge of the strength of known rocks.

NATURAL GAS IN ALBERTA.—The Canadian natural gas industry is second only to that of the United States, the annual production in the former country amounting to some 20,000,000,000 cubic feet, valued at five million dollars. The bulk of this gas comes from the provinces of Alberta and Ontario, but there are already signs of exhaustion in the eastern fields, and steps are being taken to conserve the remaining resources and to regulate the supply. In Alberta the position is different, since several large flows have recently been struck, and there are also many potentially favourable areas which have not been explored. Much of the Alberta natural gas is apparently a dry gas, so that gasoline extraction has not on the whole assumed the importance in the Canadian gas industry that it has done in the United States; one area, however, that of Turner Valley, yields a wet gas capable of giving from 0·2 to 0·7 gallons of gasoline per 1000 cubic feet of gas, which compares favourably with some of the results achieved in the Mid-Continent region of America; the gasoline-yielding gas shows on analysis, as might be expected, a much higher proportion of ethane than the dry gas, with a corresponding decrease in the nitrogen content, a point of importance in connexion with helium recovery. It seems unthinkable that helium should be allowed to go to waste in view of its enormous value for aircraft purposes, but such is largely the case in Canada at the present time. Mr. R. T. Elworthy, in his report on the "Natural Gas in Alberta" (Canada, Department of Mines, 1924 for 1923), states that from two fields, Bow Island and Foremost, some ten to fifteen million cubic feet of helium per year might be obtained at a cost of between 50 to 100 dollars per thousand cubic feet, if an efficient process were developed to treat low helium-bearing gases. He rightly points out that no private corporation can be expected to experiment on these lines; the work or research necessary well warrants State enterprise and, we may add, an Imperial backing. There is also a possibility of establishing a carbon black industry in Alberta, and the author thinks that a ready market could be found for this product providing it were sold at competitive prices with those current in Louisiana, the home of that industry.

DEPTH OF SEISMIC FOCI.—An important paper on this subject by Dr. S. K. Banerji, director of the Bombay and Alibag observatories, is published in the *Phil. Mag.* (vol. 49, pp. 65-80). The method adopted is to estimate the effects of the depth of the focus on the amplitudes of the different phases of the seismogram, assuming that the corresponding waves have the same amplitude at unit distance from the source. Taking the earth to be an infinite solid bounded by a plane, it is shown that, while the effect of the depth of the focus on the amplitudes of the primary and secondary waves at great epicentral distances is almost negligible, the amplitudes of the long-wave phase undergo a rapid decrease with increasing depth of focus. If the depth were so great as 1000 km., the amplitude of the primary and secondary waves at the antipodes should be about $2{\cdot}7 \times 10^{37}$ times as great as that of the long waves. If the depth were 200 km., the amplitude of the former would be about 400 times as great as that of the latter. If it were 100 km., the amplitude of the long waves would be about 55 times as great as that of the primary or secondary waves. Roughly speaking, therefore, about 100 km. or less is a possible depth for the seismic focus, while a depth of from 200 to 1000 km. is probably much too great. Taking the earth to be a spherical body, it is found that the depth is probably less than 100 km.

SPECTRAL FREQUENCIES IN THE REGION BETWEEN LIGHT AND X-RAYS.—Two papers are contributed by M. F. Holweck to the *C.R. Acad. Sci.*, Paris, of January 26 and March 2, in which a method of investigation is described, using very soft X-rays produced by bombarding a molybdenum anticathode with slow electrons, the velocity of which corresponds to a small potential difference V. Only the electrons from the first atomic levels are expelled, and the X-radiation forms a continuous spectrum without characteristic lines. The radiation is filtered through several sheets of celluloid, which has no discontinuity of absorption in the region investigated. The ionisation produced in argon and hydrogen chloride, sulphide, phosphide, and silicide has been examined, the ionisation current being observed for different values of V, so as to obtain the curves showing the relation $i = f(V)$ for the different gases. These have singular points at the critical potentials, and the following values have been found for Bohr's L III, L II levels, including a determination for aluminium by another method:

Ar	Cl	S	P	Si	Al
$246{\cdot}5 \pm 1$	203 ± 1	163 ± 1	128 ± 2	98 ± 2	68 ± 2

These figures are compared with those of other observers, and are found to lie well on a Moseley

diagram. The figure for argon, after certain small corrections, gives for the wave-length 50·1 ±0·2 Å.U.

QUANTITATIVE ANALYSIS WITH THE X-RAY SPECTROSCOPE.—Messrs. R. Glocker and W. Frohnmeyer show, in the *Annalen der Physik* for February, that analysis by means of the bright line X-ray spectra of the elements does not always give satisfactory results, and they suggest a number of reasons for this. They have developed a method in which the intensities in the absorption X-ray spectrum are measured, the substance to be investigated being placed between the crystal of the spectrometer and the photographic plate in the form of fine powder, a solution, a metal foil, or a plate. Measurements of the intensity are made photometrically on the record, just outside and just inside the absorption band of the element dealt with; if λ_A is the wave-length at the band head, I_1 the intensity for $\lambda > \lambda_A$, I_2 the intensity for $\lambda < \lambda_A$, p the mass of the element in the path of the rays in grams per sq. cm., and c a characteristic constant for the element, $I_2/I_1 = l^{-cp}$. The characteristic constants have been determined for elements with atomic numbers from 42 to 90 for the K absorption band, and from 90 to 92 for the L_1 absorption band. The effect of mixing other substances with the element to be determined has also been investigated. The jump at the band head of an element is smaller when the absorption due to impurities increases. If two elements with high and low atomic numbers are mixed the amount of the first can be determined with an accuracy of about ± 5 per cent. Examples are given of the use of the method in determining the amount of barium in glass, of hafnium in minerals, and of the constituents of mixtures of salts.

COLOUR PHOTOGRAPHY.—The " Jos-Pe " process of natural colour photography on paper is described in the April colour supplement of the *British Journal of Photography*. The usual three negatives are made, and from these, prints are obtained by projection of any required size on plates coated with a gelatin-bromide emulsion containing very little of the silver salt. The exposure of these plates is made through the glass, and they are developed in a pyrocatechin developer which contains no sulphite and has the property of locally hardening the gelatin in proportion to the amount of silver reduced. After fixing, the unhardened gelatin is dissolved away in hot water, and there results a gelatin relief image slightly darkened by the reduced silver. To prepare a print, each plate is soaked in its proper dye solution, rinsed to remove the dye solution from the surface, and the gelatin coated transfer-paper is squeezeed into contact with it. In a few minutes the transfer-paper has absorbed sufficient dye, and it is removed and squeezeed in turn on to the other two plates. The images on the printing-plates are so transparent that the registration offers no difficulty. If necessary a second application on either of the printing-plates may be made, and local corrections may be made by applying more colour with a brush.

BERTHELOT'S BOMB.—In a communication to the *Comptes rendus* of the Paris Academy of Sciences of February 23, Prof. C. Moureu describes the destruction of the original bomb calorimeter of Berthelot. This historic instrument was being used during the War in experiments with reactions of an explosive nature and burst on December 16, 1918, fortunately without causing any personal injury, although Prof. Moureu mentions that some minutes earlier he had the bomb in his hands. The head of the bomb lodged in the ceiling of the laboratory, 16 feet above the working bench. This bomb had been in use for 30 years for the determination of heats of combustion, and, in spite of this long period of hard wear, was in perfect condition when it burst. The question of its replacement was a difficult one on account of the present price of platinum. The original Berthelot bomb contained about 1300 grams of platinum, and at the time the instrument was built, this cost less than the same weight of gold. The present price renders an exact reproduction impossible, and in collaboration with M. P. Landrieu, a new design of bomb has been worked out. The complete inner lining of platinum has been retained, but the amount required has been reduced to 128 grams, partly by changing the form from a cylinder to a bottle with large neck, and partly by the use of a laminated sheet of platinum (0·2 mm.), gold (0·4 mm.), and copper (0·4 mm.), the whole being worked as one sheet. The new pattern instrument has been at work in the laboratory of the Collège de France, and has proved satisfactory. At the same time other changes have been made with the view of reducing the magnitude of the cooling constant, and calorimetric determinations can now be carried out with an accuracy of 1 in 1000.

CONSUMPTION OF POWER IN COAL MINING.—The University of Illinois has recently published a Bulletin (No. 144) entitled " Power Studies in Illinois Coal Mining," by Prof. A. J. Hoskin and T. Fraser, which consists of a careful study of the manner in which power is utilised in the various operations of coal mining in the State of Illinois. As in all other countries, these collieries have of late years been resorting more and more to mechanical means of performing the various operations, and this has mainly made itself evident in an increased employment of electrical power. Here, as elsewhere, colliery companies commenced by themselves generating the power which they needed in their mines, but of late years there has been an increasing tendency towards purchasing current from the electric supply companies, or, as the Americans call them, " utility companies," and it is pointed out that in some cases such companies are in a position to supply current at a lower cost than that at which the colliery companies themselves can generate it. The net result of the increased use of power has been to diminish costs, but " some of the improvements have lowered costs of coal production per ton by merely increasing production rates, whilst other mechanical innovations have lessened costs by minimising labour." In order to determine the distribution of power consumption in the collieries, data were obtained from 50 representative mines, ranging from the smallest to the largest, from a daily output of 650 tons up to one of 5200 tons. Excluding manual or animal power, it would appear that steam performs 42 per cent. of the mechanical duties about these mines, and that 58 per cent. of the energy employed is electric. The average distribution of energy in all these coal mines is classified as follows: Hoisting, 17·2 per cent.; ventilation, 22·2 per cent.; pumping, 5 per cent.; mining, 22·1 per cent.; haulage, 23 per cent.; miscellaneous, 10·5 per cent. Quite naturally, however, these averages vary between exceedingly wide limits: thus the percentage of the total energy consumption used for hoisting ranges from 1·4 per cent. to 50·8 per cent.; for ventilation, from 2·2 per cent. to 55·9 per cent.; for pumping, from 0·1 per cent. to 35·9 per cent.; for mining, from 0 (where all the coal is cut by hand) to 45·7 per cent.; for haulage, from 0 (where only mule haulage is employed) up to 51 per cent.; whilst miscellaneous services absorb from 3·6 per cent. to 23·9 per cent.

The International Geographical Congress.

THE International Geographical Congress, under the auspices of the Union Géographique Internationale, met at Alexandria and Cairo on March 28-April 9. One noticed well-known scientific men from France, Italy, Switzerland, Spain, Holland, Belgium, Poland, Yugoslavia, Greece, etc., as well as from England and Egypt. The deputations from Italy and from Poland seemed specially strong, while the French delegation included many leading members of the professoriate. The British group included Sir Francis Younghusband, who acted as its chief; Sir Charles Close, the honorary secretary of the Union Géographique Internationale; Maj.-Gen. Lord Edward Gleichen, Col. H. G. Lyons, Admiral Sir John Parry, Lieut.-Col. Craster, Dr. Newbigin, Profs. Roxby and Fleure, and Mr. W. W. Jervis.

The Congress owed its preliminary organisation to the Société Royale Géographique de l'Egypte, the secretary of which, M. Cattaoui Bey, worked very hard throughout for the success of the meeting. H.M. King Fuad honoured the Congress, in which he has taken great interest, with his presence at its opening session, and also received the members of the Congress on the first evening at the Royal Palace.

The scientific work of the Congress was organised in five sections, which met in the mornings and heard a number of papers, some of which were followed by valuable discussions. A few special addresses were given to the Congress as a whole, at sessions at which General Vaccheli, president of the Union Géographique Internationale, took the chair.

Lieut.-Col. Craster, on behalf of Major M'Leod, pleaded for reconsideration of the organisation, which is trying to promote the 1 in a 1,000,000 map scheme. That organisation is imperfect in the matter of co-operation between adjacent countries for common sheets, of placing sheets on sale in the world's great cities, and of financial support for the central bureau, which has suffered greatly through the vagaries of the international exchange markets. It is also felt that the regulations as to style of maps as laid down by a Conference at Paris have not proved satisfactory, and that different countries have executed the maps too differently. It was resolved to place the whole matter on the agenda for the next International Geographical Congress, to be held in England in 1928, and in the meantime to circularise all the nations concerned, in the hope of approximating to a common opinion.

M. de la Roncière gave an interesting summary of his well-known researches into discoveries in Africa in the Middle Ages, and showed how much was known and how much trade existed between oasis cities, for example, and the Italian republics. M. de la Roncière also exhibited a map found by him, which he showed reason to believe was a map contemporary with, and utilised by, Christopher Columbus.

Sir Francis Younghusband pleaded for better descriptive work in geography, urging that geographical writers should try to penetrate to the soul of the country they described, and should do this by learning to love the earth, as all great artists love the subjects at which they work. Prof. Collet gave a valuable paper from an English lady student in his laboratory, working under his direction. It showed how it was possible to obtain accurate photomicrographs of the layers of sediment on the floor of the Lake of Geneva. Slides were shown which made clear the succession of winter and summer layers, and allowed accurate estimation of their thicknesses.

Profs. Czckanowski and Stolyhwo brought forward methods of anthropological analyses and mapping, and a discussion followed, in which Prof. Biasutti and others took part. Father Bovier Lapierro gave a most valuable account of years of research concerning prehistoric Egypt. He has found numerous stations of various ages, within the Palæolithic epoch, especially around the Mokattam region, and it is greatly to be hoped that his work may be published *in extenso*. It raises many important points in various branches of study. The same worker further roused great interest by announcing a quite recent discovery of small but dolmen-like stone monuments in the eastern desert. This announcement was considered so important that a few members of the Congress adventured out with M. Bovier Lapierro to see these monuments. They need further examination, which the Rev. Father is undertaking, but there can be no doubt as to their interest; their age remains for the present a matter of speculation.

Prof. Arctowski presented contributions from his well-known researches in meteorology, some with special reference to attempts to ascertain periodicity of temperature variations for short periods. M. de Margerie, who presided over the section on physical geography, contributed to a plenary session of the Conference an eloquent and appropriate tribute to the work of the late Franz Schrader, emphasising Schrader's wonderful knowledge of the Pyrenees, and the great historical atlas which remains as one of the chief memorials of a lovable personality. M. Sadik Bey gave an interesting and valuable account of the geology of Sinai, and a number of other papers dealt with matters of Egyptian interest.

M. Demangeon opened a discussion on rural habitations and their distribution, in which he urged the need for re-examination of the work of Meitzen, and in the discussion which followed, Miss Lefevre, MM. Marinelli, Michotte, and others took part. Arrangements were made for publishing an account of the discussion in the *Geographical Teacher*, and for organisation of further inquiry with the view of a discussion with illustrative maps, at the 1928 Conference.

Though a visit to the famous Survey of Egypt was unfortunately omitted from the official programme, many members of the Congress arranged to spend some hours at this remarkable institution, which has created a huge map system that serves as the official property-registration for the whole of Egypt.

The Royal Geographical Society of Egypt had collected a large number of valuable large relief and geological and other models, which were much appreciated. The relief of the Aswan dam, geologically coloured, was specially eloquent.

On Friday April 3 was celebrated the jubilee of the Royal Geographical Society of Egypt, and the president of the Society gave a felicitous review of the Society's work in the great days of pioneering discovery. Representatives of the various nations offered their congratulations, those of the Royal Geographical Society of London being presented on behalf of the Society by Lord Edward Gleichen.

Naturally, visits to the unique Egyptian Museum, the Arab Museum and the mosques, the Coptic Museum and churches, the pyramids of Giza and of Saggara, the barrage of the Nile at the head of the delta, the observatory at Helwan, and many other places were made, and our Egyptian hosts showed the greatest generosity and kindness in this as in many other respects. Arrangements were made for visits, after the Congress, to Kharga oasis, Luxor, Aswan, Kosseir, and so on.

It was found that five sections gave the most practical distribution of the papers and the audience

at the Congress, and much experience was gained, which should prove useful for the Conference of 1928.

Before the meetings at Cairo, three days were spent at Alexandria, where the museum, the site of the ancient Canopus, and several other features were visited, chiefly under the enthusiastic guidance of Prof. Breccia.

The overwhelming hospitality shown to the Congress will long remain as a vivid memory. Many colleagues from various countries met for the first time, and were able to exchange opinions and thoughts on the many delightful excursions, notably on those on the Nile steamers. The warm sun and fresh breeze, the sunsets behind the pyramids, the minarets lighted for Ramadan, the citadel, and most of all the great river of history, form a picture which should make all who were present better geographers than they could be without a knowledge of the mother-land of so much civilisation.

The Preservation of Food.

IT is probable that few people realise the attention to detail which is necessary when articles of food have to travel long distances and yet reach the consumer in a condition which compares favourably with the appearance and character of the same food in the fresh state. Quite apart from the use of food preservatives, the storage of food at ordinary or low temperatures requires attention to a number of factors if success is to be obtained: to the investigation of these factors the Food Investigation Board has devoted a considerable amount of work, as revealed in its report for the year 1923.[1] The report commences with a short account of an expedition to Australia, which was sent out to investigate the cause of a disease of apples known as "brown heart," occurring during the transport of the fruit from that continent to Great Britain. Following a short section on the theory of freezing, come the reports of the six committees set up by the Board to deal with various aspects of the problems of food storage in relation to different types of food. The investigations have been carried on at various places, especially at the Low Temperature Research Station and the Biochemical Laboratory at Cambridge, at the Horticultural Research Station of the University of Bristol at Long Ashton, and in London, Manchester, and St. Andrews. About half of the report is occupied with an account of the investigations of the Fruit and Vegetables Committee, and this section can be conveniently considered together with the results obtained by the Australian Expedition.

It has been found that the following factors affect the keeping properties of stored apples: the soil and locality of the orchard, the age of the tree, the season and the presence of fungi on the fruit; the maturity of the fruit when gathered and its grading and packing; the temperature, humidity, and composition of the atmosphere of the storage chamber. The reports of the Expedition have been referred to in NATURE of February 7, p. 207, and April 18, p. 584. By regulating the temperature and composition of the air of the hold, the fruit can be kept in good condition; on the other hand, ventilation can be too efficient, since the removal of the carbon dioxide produced and the supplying of oxygen to replace that consumed hastens the process of ripening, which may thus be brought about before the fruit reaches the consumer. Hence the ventilation should be so arranged that the carbon-dioxide percentage is kept at about 10.

The problems of storing fruit in Great Britain have also been investigated: cold storage is usually superior to storage at room temperature, but in certain seasons this result may be reversed. Any deterioration which occurs in cold store is usually of a non-parasitic type and similar to that found in Australian apples in transport to Great Britain, whereas in ordinary storage the deterioration is produced by fungal disease. The species of fungi causing this deterioration have been investigated, together with the path of invasion of the fruit: the spores appear to reach the fruit in the orchard itself, and to prevent this, improved orchard sanitation is necessary; once present, however, their development can be retarded by placing the fruit in cold store. The work of this Committee also includes a number of chemical investigations on the fruit kept in storage, such as carbon-dioxide production, and changes in sugar and pectin content and in acidity, all of which will throw light on the processes occurring in the fruit during ripening and storage.

Although foods of various kinds can be preserved well by freezing, it is not easy so to conduct the processes of freezing and thawing that the food is in an unchanged condition when it finally reaches the consumer. Thus, the yolk of frozen eggs may pass into a pasty state, the change being irreversible on thawing: this can be prevented either by never allowing the temperature to fall below $-6°$ C. or by freezing and thawing with great rapidity. The work of the Fish Preservation and Meat Committees has shown that irreversible changes may occur during the freezing and thawing of fish and meat, unless the freezing is carried out rapidly, as, for example, by immersion of the food material in cold brine; in this case the autolysis of the thawed food is similar to that of fresh meat or fish, whereas if the freezing is carried out in air, fluid separates from the tissues during freezing and drips away on thawing; in this fluid autolysis is rapid, but in the remaining tissues it appears to proceed at what may be called the normal rate. An attempt was made to preserve the fish more satisfactorily by exposing it to ice containing an antiseptic; although the latter hindered the development of bacteria, which still occurred at this low temperature, yet the method was unsatisfactory, since the tissues took up considerable amounts of the antiseptic.

The Oils and Fats Committee reports work on the series of glycerol methyl ethers, the glyceryl glucosides, the constitution of glycogen, and the synthesis of the higher aliphatic acids. The formation of fat by yeasts has also been investigated; the fat is formed from the carbohydrate of the nutrient medium in the presence of oxygen, and more fat is stored if phosphorus is also present in the medium: the phosphate is taken up by the cells in association with the carbohydrate, and it is possible that a hexosephosphate forms a stage in the conversion of carbohydrate into fat. This fat contains the growth vitamin A, which is probably synthesised directly by the yeast cells.

The Canned Food Committee has investigated the chemical changes occurring in fish during the processes of canning and storage. It was found that the presence of soluble tin facilitated the production of certain degradation products of the nature of volatile bases.

The report as a whole is a good illustration of the fact that there can be no dividing line between the two branches of research which are sometimes designated as "pure" and "applied" respectively.

[1] Department of Scientific and Industrial Research. Report of the Food Investigation Board for the year 1923. Pp. iv+77+4 plates+14 charts. (London: H.M. Stationery Office, 1924.) 3s. net.

Navigation and Fishing on the Ganges.

THE first of Mr. Hornell's two memoirs[1] deals with the various navigation appliances employed on the Ganges. These are studied under two main groups, representing respectively the primitive and the advanced types. The former comprises rafts, dug-outs, skins, and other rudimentary forms adapted to simple requirements. Inflated buffalo-skins, used either singly as floats to support a swimmer, or by associating together two or more to give buoyancy to a platform-raft, are still in use locally on the Ganges, just as they are on the Tigris, as direct survivals from the ancient Babylonian and Assyrian days. It is curious that the skin-covered coracle, which also was used in ancient Mesopotamia, is not represented in this part of India; its absence being the more noteworthy since it is prevalent both in southern India and in the Trans-Himalayan regions (*e.g.* Tibet). On the Ganges its place seems to be taken by the *Tigari* of Eastern Bengal, a circular, round-bottomed pottery bowl, in which one man can sit and propel himself with a short paddle.

Of the dug-out canoes, the most peculiar are those made from the stem of the Palmyra-palm (Borassus). The base of the stem is much swollen, and the canoe, retaining the natural shape, is thickened and rounded at one end and narrow at the truncated other end, which is usually plugged with clay. These canoes are often used in pairs, lashed together to give stability. The type occurs also on the Colair Lake in Madras Presidency.

The difficulty and cost of obtaining large tree-trunks for making dug-outs is encouraging the increasing adoption of plank-built boats, of which Mr. Hornell describes several varieties, from the small, one-man *dinghi* to large barges and house-boats. The author points out that the Gangetic built-boat types do not link up with types seen farther east (Burma, Siam, and China), but with western forms; and he urges the probability of a close link with the Mediterranean vessel-types. He suggests that these boat-designs may have been introduced by Dravidians who entered India through Baluchistan. He refers to the use of the *oculus* on some of the Gangetic vessels, and offers this as an important link with Egypt and the Mediterranean. In Fig. 14 the *oculus* is described as being situate upon the "*stern*-head" and this evident misprint for "*stem*-head" occurs more than once in the text.

This treatise is a useful adjunct to one published by Mr. Hornell in the same "Memoirs" in 1920 (7, pp. 139-256).

The second memoir is devoted to the fishing methods of the Ganges, dealt with under three environmental conditions—estuarine, riverine, and lacustrine. The first and last mainly involve shallow, still-water fishing; the second—by far the most important—is chiefly characterised by swift, deep waters. The various appliances are described in detail. Spearing fish with simple, many-pointed, or harpoon-headed spears, and also shooting them with bow and arrow, are still practised extensively. The art of trapping fish has been highly developed, great ingenuity being exhibited in designing and constructing the numerous varieties of traps. The same may be said of the netting-gear, which has been even more specialised into a great diversity of types adapted to different quarries and varied waters. Line-fishing, with or without a rod, is also popular, and much ingenuity is evinced in the practice of ground-baiting. The author has added an important item to the literature of fishing, which will prove of value when a long-wanted monograph is produced dealing with the primitive fishing methods of the world, their distribution and ethnological significance.

In both these memoirs the illustrations are very good and clear. HENRY BALFOUR.

[1] "The Boats of the Ganges" and "The Fishing Methods of the Ganges," by J. Hornell. Memoirs of the Asiatic Society of Bengal, vol. 8, No. 3, 1924, pp. 171-238. Rupees 2.13.

Synthetic Methyl Alcohol.

THE first attempt to synthetise methyl alcohol by the catalytic reduction of carbon monoxide was apparently made by Sabatier and Senderens. These experiments were unsuccessful, but French research workers have persevered on the problem and the manufacture of methyl alcohol is now an accomplished fact. An accidental synthesis was carried out by the Badische Anilin- und Soda-Fabrik in 1913, during experiments carried out to investigate the possibilities of manufacturing liquid hydrocarbons by the catalytic reduction of carbon monoxide at high temperatures and pressures. No attempt was made, however, to pursue the investigation. In 1921 Calvert claimed to have obtained an 80 per cent. yield of methyl alcohol by the action of hydrogen on water gas, and in the same year Patart, Inspecteur Général des Poudres, published his first patent. A small plant was erected at Asnières and Patart's method was successfully applied.

In Patart's process the gaseous mixture, containing two volumes of hydrogen to one of carbon monoxide, is compressed to 250-500 atmospheres and, after filtration, is passed over the electrically heated catalyst (400°). The gases are then cooled and the non-condensed portion re-circulated through the apparatus. A suitable catalyst is zinc oxide; it yields a greenish liquid containing a greenish precipitate of metallic copper from the apparatus. The liquid readily yields practically pure methyl alcohol on distillation with phosphoric acid, followed by a redistillation of the first portion of the distillate. The final product has a somewhat disagreeable odour, but is perfectly free from aldehydes and ketones.

The great difficulty in working this process is to avoid side reactions. Above 300° and in the presence of certain catalysts (*e.g.* iron), carbon monoxide changes rapidly to the dioxide with deposition of carbon. The monoxide is also reduced to methane by hydrogen in the presence of nickel or iron. Conditions must be carefully adjusted to avoid these side reactions. Patart describes his process in some detail in the February issue of the *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, and discusses the prospects of its commercial adoption.

More recent work, using metallic suboxides as catalysts, has been carried out by Audibert. Higher oxides of nickel and of copper are reduced by the reaction mixture of carbon monoxide and hydrogen *in situ*, and Audibert found that with these catalysts temperature is the controlling factor. Between 225° C. and some limit between 275° and 300° C., depending on the nature of the catalyst, methyl alcohol is the sole reduction product of carbon monoxide.

Patents were taken out in Germany in 1922 for a process very similar to Patart's, and a plant was erected at Merseburg in 1923 capable of turning out about twenty tons of alcohol per day. This synthetic alcohol is now being exported by Germany in considerable quantities.

University and Educational Intelligence.

LONDON.—Prof. F. J. Cole will deliver on May 1 and 8 at King's College, at 5.30, free public lectures on "The History of Protozoology."

The following free public lectures at University College are announced: "The Physiology of Muscle and Nerve," Prof. A. V. Hill, on May 1, 8, 15, and 22, at 11, and "The Physical Environment of the Living Cell," Prof. A. V. Hill and Prof. J. C. Drummond, on May 4, 11, 18, 25, June 8, 15, and 22, at 5.30.

The latest date for the receipt of applications for grants from the Dixon Fund is May 14. Applications should be sent to the Academic Registrar, South Kensington.

THE Board of Education has issued a list (H.M. Stationery Office. Price 6*d*.) in which are conveniently brought together the numerous vacations courses to be held this summer in England and Wales. The courses are arranged alphabetically under four headings, according as they are being organised by the Board itself, by local educational authorities, by universities, or by other bodies. Among the subjects of the courses are psychology (Brighton), mining science (Amman Valley, Swansea, and Camborne), agricultural subjects (Nantwich), geography (Cambridge and Leeds), higher mathematics (Bangor), and zoology (Oxford).

THE Secretaries of the Royal Society will receive until June 1 applications for a Mackinnon Research Studentship, value 300*l*. per annum, tenable for two years with a possible extension, and for a Moseley Research Studentship of a like value and period. The first-named studentship is awarded to further natural and physical science, including geology and astronomy, and original research and investigation in pathology; the second is to further experimental research in pathology, physics, and chemistry or other branches of science, but not in pure mathematics, astronomy, or any branch of science aiming at describing, cataloguing, or systematising. The necessary application forms may be had from the Assistant Secretary of the Royal Society, Burlington House, Piccadilly, W.1.

THE second series of "Methods and Problems of Medical Education" has been issued by the Division of Medical Education, Rockefeller Foundation. It contains an introduction by Prof. Rosenau of the Harvard Medical School on the sanitary survey as an instrument of instruction in medical schools, and the reproduction (by photo-lithography) of the report of a sanitary survey of Rochester, New Hampshire, carried out and reported by Mr. Shields Warren while a third-year student in the Harvard Medical School. The survey is a model of what such a survey should be, and reflects great credit on the medical curriculum of the Harvard School. Nothing of the kind has been attempted in Great Britain, even in the curriculum for the future medical officer of health.

THE University College Committee of the University of London gives prominence in its report for the year ending February 28, 1925, to the need of additional funds for the equipment of the College laboratories for physical and electrical chemistry and engineering, for the new buildings for the Department of Zoology and Comparative Anatomy, and for additional museum cases and improvement of the animal houses in the Department of Applied Statistics. An appendix to the report, showing the geographical distribution of students in 1923–24, gives the names of no less than fifty countries outside the United Kingdom. The total number of students from these countries was 518, including 90 from India, 43 from the United States, 36 from Japan, 35 from Switzerland, 29 from Australia, 27 from France, and 22 each from South Africa, Holland, and Russia. Among lecturers from abroad were 2 from Austria, 4 from the United States, 2 from Holland, 2 from France, and 1 each from Russia, Germany, Belgium, and Italy.

NATIONAL physical deterioration, as disclosed by Army recruiting officers' reports, formed the subject of a recent leading article in the *Times* (Educational Supplement), which concluded with the remark that although all parties are agreed as to the evil, little is being done towards remedying it, and the process continues. In the same issue appeared articles on the inadequacy of existing school buildings, on the excessive size of classes, on juvenile unemployment, and on the dangers involved in the schools turning out large numbers of young people who, having been educated without a thought of future work, cannot find work for which they are fitted. For all these problems a solution is offered by the Calcutta University Poverty Problem Study lecturer, Capt. J. W. Petavel, R.E. (retired), in his scheme for the organisation of educational labour colonies combining features of the Swiss labour colony and of trade and agricultural schools. Capt. Petavel, who has for some years conducted a polytechnic institute on lines intended to fit boys to work in co-operative organisations, obtained for his scheme the support of the late Vice-Chancellor of the University of Calcutta, Sir Asutosh Mookerjee, and many other prominent citizens of Calcutta, including the editor of *Capital*, who published a series of articles by him last January and February. These have been republished by *Capital* in pamphlet form together with a number of other papers on "Unemployment and the Calcutta University Propaganda for a solution by Educational Colonies, Home-crofting, and Home-crafting."

THE Board of Education issues from time to time valuable memoranda on the teaching of some school subject. These documents present the considered suggestions of the Board based on long observation in the schools and from the point of view of the educational discipline of future citizens. Such a memorandum would be welcomed by all teachers of geography, many of whom have been endeavouring for many years to find the best methods of teaching a necessary but admittedly difficult subject. The inquiries of the British Association Committee on Geography Teaching showed that remarkable unanimity prevailed among teachers as regards the purpose of geography, but extreme diversity marked the methods and practices of teaching. At the request of this Committee, the Council of the Association has expressed to the Board of Education the hope that a memorandum will be issued on the teaching of geography. There is of course no royal road in geography or any other subject, but it is an advantage to know what has been found expedient and useful. It is admitted that the home region must form the laboratory of direct geographical observation, but how should this laboratory be used? What geographically are fundamentals in the teaching of the British Isles, the British Empire, the world? What are the best methods of keeping one's knowledge of the world up-to-date? A memorandum would pool experiences and give form and coherence to the subject without stereotyping the teaching.

Early Science at Oxford.

April 27, 1686. The Society gave Mr. Musgrave their thanks for ye care and paynes he has taken in executeing the office of Secretary.

Dr. Bagley's letter of Nov. 26th. 1683, and Dr. Tyson's of December 6th., both concerning ye *Lumbricus latus* were read.

Dr. Smith communicated part of a letter from France, wherein some mention was made of young dogs recovered from drowning, by some salts.

Mr. Musgrave communicated a Discourse which he received from a freind of his concerning *Dyalling*: Mr Caswell was desired to give the Society some account of it the next meeting.

1687. Mr. President was pleased to communicate a Discourse concerning the Regulation of Easter, for 2000 years, and the moveable feasts according to the computation of the Church of England.

Mr. Caswell gave an account of some bodys weighed hydrostatically, by weighing them in aer and water. 'Twas observd by him that the Calculus humanus is lighter in specie than any known sort of Stones.

April 28, 1685. A Letter from Mr. William Molyneux dated Dublin April 4 was read; in it was contained a Transcript of Sir William Petty's *Supellex Philosophica*, as it was presented to the Dublin Society, which also was read, and the thankes of ye Society ordered to be returned for it.

Mr. Aston communicated an account of ye Curiosities brought from Ceylon by Dr. Heerman, Professor of Botanics at Leyden.

A Letter from Dr. Pierce of Bath dated April 11 was read; it gave a farther relation of the Evets found alive in ye middle of a stone.—Dr. Cole of Worcester then described a case of Haemophoria, after which Mr. Bainbrig affirm'd, that ye little end of a Dutch Tobacco-pipe (ye piece about 2 inches in length) having been thrust into ye bladder by a Boy was cut out, and is now to be seen at Leyden.

A Letter from Mr. Aston was read containing a proposall of Dr. Lister's of cutting for ye stone by entering ye Abdomen a little above ye Os Pubis, and opening the ffund of the bladder; on which account Mr. Bainbrig informed the Society, that one, Colbron, a Chirurgeon at Haysham in Sussex, has taken out the stone of the bladder this way with successe. Mr. Bainbrig is desired by the Society to procure a full Relation of the particulars of this Operation; and Mr. Pigot is desired to try ye Experiment on a Dog.

April 29, 1684. Mr. President, takeing ye chair, gave order for ye reading of a letter dated April 24, from Mr. Aston; which affirmed, that ye experiment of makeing Plaister of Paris perspicuous, by striking turpentine thro it, was tried, and succeeded, before ye Royall Society. The substance mentiond in ye Minutes of Aprill ye 15th, and sometimes supposd to be a petrifyed heel of a shooe, breaking when bor'd; ye peices of it were produced, and judged to have been *allwais* stone: This gave occasion to some discourse, concerning such stones as are of a shape resembling some other body in nature, and are not found in beds, of which sort ye stone now mentiond is an example: and Dr. Plott acquainted ye Society, that he found a stone in Staffordshire in form like ye *heart* of a pullet; haveing lines in it, answering to ye coronary vessells of that muscle.

A Letter from Dr. Huntingdon to Dr. Plott, concerning ye porphyry pillars in Ægypt, was read: in it were enclosed ye draughts of two Pillars taken in that place. This letter being written at ye request of this Society, it was order'd that our thanks should be returnd to Dr. Huntingdon for this obligation.

Societies and Academies.

LONDON.

Geological Society, March 11.—O. T. **Jones**: The geology of the Llandovery district (Carmarthenshire). The district lies east of the town of Llandovery, and extends for about 10 miles from north-east to south-west. It is divisible into a northern area and a southern area. In each area the succession is fairly complete, but in between them it is greatly attenuated. In proceeding from south to north, certain lithological changes have been noted in the Lower Llandovery. The fauna in the rocks appears in the main to have been drifted into the area from an adjoining tract, lying probably nearer to the shore-line. In addition to the differential subsidence and uplift along lines trending north-east and south-west, there is evidence of repeated elevation and depression along nearly east-and-west axes. The axes of these transverse movements appear to have persisted during the whole of the Llandovery epoch, but there is no evidence of them in the Wenlock rocks.—G. **Andrew**: (1) The Llandovery and associated rocks of Garth (Breconshire). The Llandovery rocks lie north-west of Garth railway station, and extend from there in the direction of Newbridge. The Lower Llandovery rocks overlie the Bala with a sharp boundary, but with apparent conformity. The Middle Llandovery occurs in one small outcrop in the centre of the area, and is rapidly overstepped by the Upper Llandovery in both directions. The Upper Llandovery consists of two types, a lower comprising sandy mudstones with *Pentamerus oblongus*, etc., and an upper of pale mudstones ("Tarannon Pale Shales"). (2) The relations between the Llandovery rocks of Llandovery and those of Garth. At Garth, as at Llandovery, the Lower and Middle Llandovery rocks are overstepped both north and south by Upper Llandovery or Wenlock deposits. At Garth they crop out in an elongated oval area; at Llandovery they form two roughly oval areas. The Middle Llandovery and the higher divisions of the Lower Llandovery are represented only in the central regions. These distributions are due to the fact that differential movements along nearly east-and-west axes (that is, transversely to the present strike) were in progress during the Llandovery epoch. The regions where the older Llandovery rocks are most complete were regions of persistent subsidence. The axes of elevation in both areas cross the present strike at practically regular intervals of about 5 miles, and the areas of subsidence are situated nearly midway between them.

Linnean Society, March 19.—S. **Hirst**: Species of mites of the family Trombidiidæ found on lizards. When more than one form occurs on the same host, a flattened form lives under the scales, and a rounded form between the toes or toe pads. In view of the considerable differences in the shape of the setæ, etc., these are regarded at present as distinct species.—Mrs. Muriel **Roach**: A study of the physiology of certain soil algæ in pure culture. Although a very few species carried on the synthesis of organic substance from carbon-dioxide and water through the agency of sunlight, the great majority of those studied grew much better when supplied with an additional source of carbon, glucose being especially favourable to many species. A single species was selected for a more detailed investigation of the effect of different organic substances on its growth in liquid media. The alga was able to grow in complete darkness, given a suitable supply of food, at about half the rate that it grew in the same medium in the light. The logarithmic values of the bulk for the first nine

or ten days, in media completely favourable to the growth of the organism, lie on a straight line. The data indicate the importance of the compound interest law which evidently underlies the growth of the organism during the initial part of its growth. The theory of the auto-catalytic nature of growth does not appear to hold.—J. M. **Brown**: Some Collembola from Mesopotamia. Fifteen species of Collembola collected mainly in the neighbourhood of Bagdad and Amara, in Mesopotamia. Ten species and one variety are regarded as new. The Collembolan fauna of Mesopotamia shows much closer affinity with that of the Palæarctic than with that of either the Oriental or the Ethiopian regions.

CAMBRIDGE.

Philosophical Society, March 2.—H. Munro **Fox**: (1) Biology of the Suez Canal; (2) The effect of light on the vertical movement of aquatic organisms.—J. **Brill**: On a group having the Lorentz group for a sub-group.—A. W. **Veater**: On transvectant series.—E. V. **Appleton** and M. A. F. **Barnett**: A note on wireless signal strength measurements made during the solar eclipse of January 24, 1925. Measurements at Cambridge on short wave wireless signals from London have shown that the signal intensity exhibits variations which, though practically inappreciable during the day, become apparent about sunset and continue throughout the night. Typical sunset variations were found to be associated with the recent solar eclipse. The variations are attributed to interference between the direct ray along the ground and an indirect ray returned from the upper atmosphere. Such an indirect ray may be produced by ionic deviation without undue absorption if the mean free path of the effective ions is large, as suggested by Larmor. If the carriers are electrons, however, the action of the earth's magnetic field on the phase velocity of the radiation cannot be neglected. The possibility of a violation of the reciprocity relation between two wireless stations is thus suggested (*v.* also NATURE, March 7, p. 333).—H. W. **Turnbull**: A geometrical treatment of the correspondence between lines in three-fold space and points of a quadric in five-fold space.—J. B. S. **Haldane**: The origin of the potential differences between the interior and exterior of cells.—V. **Nath**: Spermatogenesis of *Lithobius forficatus*.—J. **Gray**: The mechanism of cell-division (II.).—J. T. **Saunders**: The trichocysts of Paramœcium.

EDINBURGH.

Royal Society, March 23.—Andrew **Balfour**: Reflections on malaria. Discussing the geographical distribution of malaria, special reference was made to the case of Scotland. Formerly malaria was prevalent in Scotland, but it has now declined. Anophelines still abound in Scotland, and it is quite possible that indigenous cases of malaria still occur. A combined mosquito and malaria survey might well be undertaken, if only from the scientific and academic point of view. In discussing malaria as a cause of death, emphasis was laid on the condition of liver failure which so often occurs. The value of the splenic index as a diagnostic method was considered, and its limitations defined. The introduction of stovarsol as a rival to quinine in the treatment of malaria and the nature of the malaria toxin were discussed.

MANCHESTER.

Literary and Philosophical Society, February 17.—J. M. **Gulland** and R. **Robinson**: The constitution of codeine and thebaine. Experimental evidence was adduced in favour of the assumption that dihydrooxycodeinone contains the group —CO—CH_2—. Thebaine and codeine are now regarded as containing the groups —C(OMe)=CH—CH=C< and —CH(OH)—CH=CH— respectively, whilst the ethanamine chain —$CH_2 \cdot CH_2$—NMe— connects positions 9 and 13 in the phenanthrene ring. The new formulæ are closely allied to the bridge formulæ previously suggested.

March 3.—A. **Lapworth**: (1) A comparison of some properties of cyanohydrins, carboxylic acids and phenols. The abnormalities of the $\cdot CO_2H$ group are notorious. It is now shown that the charged (CO_2) radicle of the carboxylic acid *ion* behaves as if it were a single atom, and that on this conception the relative strengths of most *meta-* and *para-* substituted phenols, anilines, and benzoic acids are in excellent harmony with the application previously made of the principle of induced alternate polarities to the affinity constants of the cresols. (2) Replaceability of halogen atoms by hydrogen atoms: a general rule. Some ions, such as $H^{\cdot}$ and diazonium ions, some elements, including ozone, the halogens, and some compounds, including hypochlorous acid, carbonyl compounds, and $\alpha\beta$-unsaturated ketones, etc., have some properties in common and are termed "cationoid." Ions, such as CN′, C:C.R′, OEt′, OH′, the negative ions of *sodio*-malonic ester, and some non-ionised compounds such as NH_3, ethylenic and acetylenic hydrocarbons, phenol ethers and vinyl ethers, have other properties in common, and are termed "anionoid." The "anionoid" properties of ethylenic hydrocarbons are held to be closely related to Thomson's observation that methyl is frequently observed in vacuum tubes with a positive charge, but never with a negative charge. The addition of a negatively charged ion to one of a pair of doubly-bound carbon atoms would leave the other as a tervalent carbon atom with a negative charge. These generalisations are closely related to the ease of replaceability of a halogen atom by hydrogen, and the following rule is stated: If X-H is an acid or compound in which H may be displaced by the direct action of an alkali or of a metal, then the halogen in X-Cl, X-Br, X-I will have some "cationoid" properties, and will be easily replaced by hydrogen. This rule is true whether XH is a so-called "tautomeric system" or not.

PARIS.

Academy of Sciences, March 9.—A. **Desgrez**, H. **Bierry**, and L. **Lescœur**: The blood globules and alkaline reserve.—S. **Winogradsky**: A method for estimating the nitrogen fixing power of soils. The medium chosen is a silica gel, for the preparation of which exact details are given. The number of azobacters is determined in the course of the operation, the amount of nitrogen fixed being estimated by the usual Kjeldahl method. It is claimed for the method that it can be used by agricultural chemists who are not experts in microbiology.—Luc Picart was elected corresponding member for the section of astronomy in succession to the late M. Stéphan.—Sir John Russell was elected a corresponding member for the section of rural economy in succession to M. Winogradsky, elected foreign associate.—M. **Légaut**: Skew algebraical curves.—Gaston **Julia**: Series of iteration and quasi-analytic functions.—Pierre **Humbert**: Zonal hyperspherical functions.—Léon **Pomey**: The theorem of existence and two modes of representation of the solutions of ordinary differential equations.—W. **Stozek**: The direction of harmonic functions in the neighbourhood of an exceptional point.—A. **Lafay**: The eddy currents of rotating cylinders.—Léon **Bloch**,

Eugène **Bloch**, and Georges **Déjardin**: The spark spectrum of neon. Wave-lengths and intensities of the lines of the neon spark spectrum are given for wave-lengths between 4922 and 2757.—M. **Charron**: The resultants of the radiation pressures on the walls of any cavity whatever.—Pierre **Goby**: Stereoscopic microradiography in relief and in pseudo-relief: the stereomicroradiograph.—Stefan **Triandafil**: The influence of acidity on the galvanic polarisation of nickel.— — **Tourneux** and Mlle. **Pernot**: The aqueous and acetone solutions of potassium bromo- and iodomercurates.—Fred **Vlès** and Edmond **Vellinger**: Remarks on the variations of the rotatory power of tartaric acid as a function of the P_H. The relation between the rotatory power and hydrogen-ion concentration of tartaric acid has been studied experimentally over the range P_H 0-14. By applying the usual formula for the dissociation equilibria of dibasic acids and calculating the rotation as the sum, for each P_H, of the rotations of the two ions and its residue of dissociation, the experimental results are explained.— — **Lemarchand**: The carrying down of magnesium by calcium oxalate.— — **Yvon**: Syntheses made starting with the sodium derivative and the mixed magnesium derivative of methylacetylene.—H. **Rosset**: Phosphorus chloronitride. $PNCl_2$ treated in toluene solution with phenylmagnesium bromide gave as one of the products of the reaction the compound $(PN(C_6H_5)_2)_3$. The constitution developed for this substance is based on the formula attributed to phosphorus chloronitride by Wichelhaus and Stokes.—Marcel **Godchot**: The two 1.3-dimethyl-4-cyclohexanones and the corresponding dimethylcyclohexanols. The existence of four 1.3-dimethylcyclohexanols is proved.—A. **Demolon**: The texture of the quaternary sediments and the soils derived from it.—Jovan **Cvijic**: The Merokarst.—L. **Lutz**: The specificity of some hymenomycetes growing on wood. Some of these fungi grow exclusively on certain species of plants, and this peculiarity has been supposed to be due to the presence in these plants of substances necessary to the life of the parasitic fungi. The experiments described tend to show that the specificity of these fungi is not due to the presence of suitable nutritive substances, but, on the contrary, to the presence or absence of certain substances injurious to the growth of the fungus.—J. **Nageotte**: The extreme contraction of striated muscle in the frog.—Léon **Blum** and Maurice **Delaville**: The study of the modifications of the blood and humours by ultrafiltration.—A. **Rochon-Duvigneand**, E. **Bourdelle**, and J. **Dubar**: The determination of the monocular anatomical visual field of the horse by the method of the transcleral image.— — **Abelous, Argoud**, and **Soula**: The structural modifications of certain organs, especially the pancreas, in animals without spleen.—L. **Mercier** and Raymond **Poisson**: Hens with crossed beaks. A coaptation of mechanical origin.—Robert **Weill**: Experimental retardation of the nematocysts in the Cœlenterata. Rendering permeable the capsular wall.—Boris **Ephrussi**: The fecundation membrane of the egg of the sea-urchin (*Paracentrotus lividus*). The action of the cœlomic liquid.

March 16.—Paul **Appell**: Extension of a theorem of Monge.—P. **Widal**, P. **Abrami**, **Diaconescu**, and **Gruber**: Digestive hæmoclasia and the state of neuro-vegetative tonus. Objection has been taken to some of the earlier experiments published by the authors on the ground that there is insufficient proof that the results are wholly due to the condition of the liver. Additional experiments have been carried out, specially arranged to test the validity of this objection. The results confirm the original experiments.—André **Blondel**: A method of harmonic analysis of the waves of alternating currents by comparison with a polyharmonic standard alternator.—J. B. **Senderens**: The preparation of cyclohexenols by the catalytic dehydrogenation of cyclohexanediols. By testing the cyclohexanediols (resorcite, quinite) with from 3 to 4 per cent. of diluted sulphuric acid ($H_2SO_4 + 3H_2O$) a mixture of cyclohexadienes and cyclohexenol is obtained, and the conditions can be arranged to give either the hydrocarbon or alcohol as the main product. Details of the preparation, properties, and reactions of Δ_3-cyclohexenol from resorcite and from quinite are given.—Ph. **Glangeaud**: The rôle of the secondary volcanoes in the Monts Dore massif during the glacial periods. The volcano of Saint-Pierre-Colamine (Puy-de-Dôme). The existing topography of the Sancy volcano is the result of the action of numerous secondary volcanoes arising on its sides, afterwards brought into relief by glacial action.—M. René Kœhler was elected a corresponding member for the section of anatomy and zoology.— — **Kraïtchik**: Fermat's numbers.—G. Y. **Rainich**: A representation of surfaces.—Paul **Urysohn**: A metric universal space.—Maurice **Fréchet**: The notion of the differential in general analysis.—Henri **Milloux**: Meromorph functions with asymptotic value and the theorem of Picard.—St. **Kempisty**: A new method of integration of measurable functions not capable of summation.—J. **Guillaume**: Observations of the sun made at the Observatory of Lyons during the fourth quarter of 1924. Details of observations on spots and faculæ made on 60 days during the quarter.—Aubusson de **Cavarlay** and Descours **Desacres**: An automatic method of drawing roads. The apparatus, placed upon a vehicle moving over a road, records the plan of the road in three dimensions.—F. **Baldet**: The third negative group of carbon, the so-called comet-tail spectrum. Extension of the red end and the structure of the bands. The carbon monoxide was under a pressure of 10^{-4} mm., the spectrum being induced by electronic bombardment, with 20 minutes' exposure of the plate. This reproduces exactly, with the same relative intensities of the bands, and in the minutest detail, the well-known comet-tail spectrum.—J. **Laffay**: The spark spectrum of mercury in the extreme red.—Jean **Lecomte**: The infra-red absorption spectrum of the alcohol function. By the use of a fluorspar prism, the region 2·75 μ to 8 μ has been studied. The mono-alcohols show two zones of strong absorption: from 3 μ to 3·5 μ and from 6·85 μ to 8 μ. Details of the absorption bands of twenty-six alcohols are given.—E. **Huguenard**, A. **Magnan**, and A. **Planiol**: A hot-wire apparatus for the determination of great altitudes. A modification of the hot-wire anemometer: at a height of 14,000 metres its sensibility is nearly eight times that of a barometer.—Mlle. Irène **Curie**: The homogeneity of the initial velocities of the α rays of polonium. There are no indications of differences of initial velocities of the α rays of polonium. If uniform distribution of velocities is assumed, the extreme deviation does not exceed 0·3 per cent.—Louis Jacques **Simon**: The relation between the structure of the unsaturated mono-carboxylic acids and their comparative sulphochromic oxidation.—J. **Orcel**: Two clinochlores containing chromium from Togo.—Jean **Jung**: Some types of crushed rocks from the Vosges.—Louis **Barrabé**: The nature of an eruptive massif, the "Antatika-Ambereny," from the west of Madagascar.—L. **Cayeux**: The relative age of the phthanites and dolomites of the carboniferous limestone of the North of France and of Belgium.—J. **Savornin**: The Djebel Ayachi (Morocco).—J. **Thoulet**: Submarine volcanoes at great depths.—Gabriel **Guilbert**: The causes

of the rapid destruction of cyclones.—Paul **Guérin**: The anther of the Gentianaceæ. The development of the pollen sac.—Pierre **Lesage**: Extension of acquired character and facts of heredity in *Lepidium sativum* watered with salt water. The alteration in the seed produced by salt water is an acquired character preserved after three generations in the absence of salt.—A. **Maige**: The evolution and "greening" of the plasts in the cotyledon cells of various leguminous plants during germination.—M. **Bridel** and C. **Charaux**: On an unstable glucosidic complex in the bark of the stem of *Rhamnus cathartica*. A complex glucoside extracted from the bark gives on hydrolysis primeverose and derivatives of oxymethylanthraquinone.—E. and G. **Nicolas**: Hexamethylenetetramine can serve as a food for plants. New researches on bean and white mustard.—Mlle. F. **Coupin**: The state of the brain at birth in the chimpanzee.—R. **Herpin**: Egg production and development in a sedentary polychetal annelid, *Nicolea zostericola*.—Auguste **Lumière**: Some new anticoagulating bodies of definite chemical composition. Of eighteen compounds studied, five have shown a high anticoagulating power. Of these, sodium mucate is anticoagulating at a concentration of 0·4 per cent. and has no toxic power.—Emile F. **Terroine** and H. **Spindler**: The influence of various methods of pasteurisation by heating on the digestibility of the albumenoid and mineral constituents of milk. Three methods were compared: heating to 63° C. for 25 minutes with stirring, heating to 95° C., and the Stassano method. None of the methods interferes with the digestibility of the milk.—Jules **Amar**: Mercurial poisoning and vital coagulation.—A. **Malaquin**: The germinal cells (gonocytes) are, in the course of the asexual reproduction of *Salmacina Dysteri*, the source of the blastogenic proliferation.—Marc **Romieu**: A new chemical reaction of dry proteid materials applicable to histochemistry. Sirupy phosphoric acid at about 50° C. gives a purple changing to violet with proteids. It appears to be a tryptophane reaction and is not given by gelatin.—Ph. **Joyet-Lavergne**: The reactions of a tissue to parasitism; lipoidogenesis and lipogenesis.

ROME.

Royal Academy of the Lincei, December 7.—Gabriella **Armellini Conti** and G. **Armellini**: Visual brightness of lunar seas. The fact that the mean brightness of lunar seas is about 0·048 and that of the land areas about 0·096 indicates that the seas represent gigantic laval and basaltic lakes, whereas the land area is constituted largely of trachite and pumice.—M. **La Rosa**: Radial velocities and the ballistic theory of variable stars.—Luigi **Palazzo**: Magnetic determinations in the larger islands of the Mediterranean Sea.—Secondo **Franchi**: New traces of overthrust in the Western Alps.—Mario **Manarini**: The problem of primitive functions.—Paolo **Stranco**: Deduction and interpretation of some Einsteinian ds^2 symmetrical about an axis.—L. **Matteuzzi**: Determination of forced and free seiches by means of a Volterra's integral equation of the second species.—Bruno **Finzi**: A new hydrodynamic paradox.—Vittorio **Nobile**: The possibility of a rigorously rational arrangement of the fundamentals of stellar position astronomy.—Giorgio **Abetti**: Spectroscopic parallaxes of the stars belonging to Secchi's first type.—Remo de **Fazi**: Studies on the indones. VI. Methods of preparing indones.—P. **Leone**: Organo-metallic compounds of aluminium. Various aluminium alkyl halides and also aluminium phenyl iodide have been prepared by boiling the alkyl halides, in very dry condition, with metallic aluminium.—Paolo **Principi**: New observations on the geology of the deep valley of Tevere.—E. **Onorato**: Celestine from S. Gaudenzio (Senegal).—E. **Caroli**: A cavitied Mysidacea (*Spelæomysis bottazzii*) from Terra d' Otranto.—S. **Sergi**: The myorabdotic cellular groups of the lumbo-sacral region of the spinal medulla of the chimpanzee.

January 18.—F. **Cavara**: Floral atrophy in *Phœnix dactylifera* from Cyrenaica. The atrophy to which the male flower of the date palm is sometimes subject in the neighbourhood of Benghazi is shown to be due to attack by an organism which belongs to the Mucedineæ and is reproduced only by conidia; for this organism, previously not described, the name *Mauginiella Scaettæ* is proposed.—Fil. **Bottazzi**: Influence of temperature on the tissues and on their colloidal components. VII. Rigidity caused by cold.—Luigi **Fantappiè**: Reduction of Pincherle's distributive operations to Volterra's linear functionals.—F. **Vercelli**: Results obtained during the cruise of the Italian royal ship *Marsigli* in the Straits of Messina. This paper consists solely of tidal data.—E. **Fermi**: Collision between hydrogen nuclei and atoms. The collision between a nucleus and an atom of hydrogen results finally in two nuclei and an electron, all separate. When the relative energy of the collision is greater than that of ionisation, ionisation may occur continuously.—Maria **De-Angelis**: Presence of vesuvianite in the asbestiferous deposits of Val Malenco.—Roberto **Savelli**: Transmission of mutations through inter-specific hybridisations; procedure in the first series of experiments. Apart from its great technical limitations, inter-specific hybridisation repeats the results of pure succession and shows that, whether the direct physiological cause of the somatic extrinsications of the mutation be of hormonic or other character, its genetic substrate consists of a Mendelian unit.—Mario **Gianotti**: Variations produced in the ammonia content of the blood by exertion at high and low altitudes. During a state of rest, the blood of a human being at a great altitude (more than 4000 metres) contains more ammonia than on the plains; this phenomenon may be explained by the acapnia produced by rarefied air. Since, then, the blood exhibits diminished alkalinity at a height, fatigue will the more readily result in a condition of acidosis which will require the circulation of abnormally large amounts of ammonia.—A. **Rabbero**: Action of sea-bathing on the reaction of the blood. Sea-bathing, during which continued swimming is indulged in, is followed, not only by vigorous pulmonary ventilation and increased elimination of carbon dioxide, but also by diminished power of the blood to resist changes in its reaction. The bases remaining in the blood are rapidly expelled, presumably by way of the kidneys.—Constantino **Gorini**: Further investigations on mammary microflora.

VIENNA.

Academy of Sciences, February 12.—A. **Bachofen-Echt**: The discovery of iguanodon tracks in the Neocomian of the island of Brioni near Pola. Near Cape Rocca in Brioni the strata of Neocomian limestone are almost exactly horizontal. The massive slabs of easily worked fine-grained stone have been quarried back from the cliff edge. Ripple marks show that in the chalk era there was a flat shore here. Two sorts of tracks are found—a three-toed footprint 26 cm. long, another 13 cm. long, perhaps iguanodons of different ages; also five-toed tracks, perhaps tortoises.—L. **Waldmann**: The geological structure of the primitive rocks between the Moldau and Danube on the survey sheet Gmünd. The principal rocks are orthogneiss, amphibolite, granulite, granite-gneiss, etc.—R. **Danzer**: Organic compounds of lead.

Official Publications Received.

Department of Commerce: U.S. Coast and Geodetic Survey. Serial No. 285: Tides and Currents in New York Harbor. By H. A. Marmer. (Special Publication No. 111.) Pp. v+174. (Washington: Government Printing Office.) 30 cents.

The Carnegie Foundation for the Advancement of Teaching. Nineteenth Annual Report of the President and of the Treasurer. Pp. vii+236. (New York.)

Ministry of Agriculture, Egypt: Technical and Scientific Service. Bulletin No. 47: Cotton Growing in relation to Climate in Egypt and the Sudan. By C. B. Williams. Pp. ii+31+9 plates. Bulletin No. 56: The Buff-Backed Egret (*Ardea Ibis*, L., Arabic *Abu Qerdan*) as a Factor in Egyptian Agriculture. By T. W. Kirkpatrick. Pp. ii+28. (Cairo: Government Publications Office.) 5 P.T. each.

Board of Education. Syllabus of the Science Scholarships Examination, 1926. Pp. 24. (London: H.M. Stationery Office.) 6*d*. net.

Sixth Annual Report of the Governors of the Imperial Mineral Resources Bureau. Pp. 25. (London.)

Stonyhurst College Observatory. Results of Geophysical and Solar Observations, 1924; with Report and Notes of the Director, Rev. A. L. Cortie. Pp. xix+44. (Blackburn.)

The University of Chicago: Publications of the Yerkes Observatory. Vol. 3, Part 4: The Forms and Motions of the Solar Prominences. By Edison Pettit. Pp. v+205-240+plates 27-37. (Chicago: University of Chicago Press.)

University Grants Committee. Report, including Returns from Universities and University Colleges in Receipt of Treasury Grant, Academic Year 1923-1924. Pp. 44. (London: H.M. Stationery Office.) 3*s*. 6*d*. net.

The Journal of the Royal Anthropological Institute of Great Britain and Ireland. Vol. 54, 1924, July to December. Pp. 211-370+15+x. (London: Royal Anthropological Institute.) 15*s*. net.

United States Department of Agriculture. Department Bulletin No. 1281: Relative Utilization of Energy in Milk Production and Body Increase of Dairy Cows. By J. August Fries, Winifred Waite Braman and Donald C. Cochrane. Pp. 36. (Washington: Government Printing Office.) 10 cents.

Department of the Interior: Bureau of Education. Bulletin, 1924, No. 31: Statistics of State School Systems, 1921-22. Prepared under the Direction of Frank M. Phillips. Pp. 42. 5 cents. Bulletin, 1924, No. 38: Statistical Survey of Education, 1921-1922. By Frank M. Phillips. Pp. 30. 5 cents. Bulletin, 1924, No. 35: The Trend of College Entrance Requirements, 1913-1922. By Harry Charles McKown. Pp. iv+172. 20 cents. (Washington: Government Printing Office.)

Records of the Albany Museum. Vol. 3, Part 4, March 6th. Pp. 257-368+plates 9-19. (Grahamstown.) 10*s*.

Ministry of Public Works, Egypt: Physical Department Paper No. 17: The Upper Currents of the Atmosphere in Egypt and the Sudan. By L. J. Sutton. Pp. iv+136+18 plates. (Cairo: Government Publications Office.) 10 P.T.

Reports of the Council and Auditors of the Zoological Society of London for the Year 1924, prepared for the Annual General Meeting to be held at the Society's Offices in Regent's Park on Wednesday, April 29th, 1925. Pp. 79. (London.)

Ministry of Agriculture, Egypt: Technical and Scientific Service. Bulletin No. 54: Notes on the Fungus *Rhizopus Nigricans* Ehr., in Relation to Insect Pests of the Cotton Plant in Egypt. By T. W. Kirkpatrick. Pp. ii+28. (Cairo: Government Publications Office.) 5 P.T.

British Museum (Natural History). British Birds: Summer Visitors. Series No. 2, Set C13. 5 picture postcards. 1*s*. Series No. 3, Set C14. 5 picture postcards. 1*s*. British Flowering Plants. Series No. 5, Set F8. 5 picture postcards. 1*s*. Series No. 6, Set F9. 5 picture postcards. 1*s*. Crustacea. Series No. 1: Crabs and Lobsters. Set L3. 5 picture postcards. 6*d*. Colour Changes in Flatfishes. Set M2. 5 picture postcards. 6*d*. (London: British Museum (Natural History).)

Diary of Societies.

SATURDAY, APRIL 25.

ROYAL INSTITUTION OF GREAT BRITAIN, at 3.—W. P. Pycraft: Use and Disuse and their Effect on the Bodily Structure of Animals (I.).

MONDAY, APRIL 27.

ROYAL IRISH ACADEMY, at 4.15.

INSTITUTE OF ACTUARIES, at 5.—W. Palin Elderton and A. H. Rowell: Some Approximations from Valuation Statistics.

INSTITUTION OF MECHANICAL ENGINEERS (Graduates' Section, London), at 7.—Exhibition of Industrial Kinematograph Films.

INSTITUTION OF ELECTRICAL ENGINEERS (North-Eastern Centre) (at Armstrong College, Newcastle-on-Tyne), at 7.15.—Annual General Meeting.

INSTITUTION OF AUTOMOBILE ENGINEERS (Scottish Centre) (at Royal Technical College, Glasgow), at 7.30.—M. Platt: The Accessibility of the Pleasure Car Chassis.

ROYAL SOCIETY OF ARTS, at 8.—Prof. J. S. S. Brame: Motor Fuels (Howard Lectures) (II.).

ROYAL SOCIETY OF MEDICINE (Odontology Section), at 8.—Clinical Evening.

FARADAY SOCIETY (at Chemical Society), at 8.—A. E. Ollard: Adhesion of Deposited Nickel to the Base Metal.—H. Sutton: The Brittleness of Zinc Plated Steel.—W. A. Naish: The Partition of Silver between Lead and Zinc.—H. J. Poole: The Elasticity of Gelatin Jellies and its Bearing on their Physical Structure and Chemical Equilibria.—Dr. E. K. Rideal: Note on the Reduction Potential of Dicyanquinhydrone.—D. B. Macleod: (*a*) Some Physical Properties of Water; (*b*) The Relation between the Viscosities of Liquids and their Molecular Weight.

ROYAL GEOGRAPHICAL SOCIETY (at Æolian Hall), at 8.30.—C. P. Skrine: The Alps of Kungur.

TUESDAY, APRIL 28.

ROYAL DUBLIN SOCIETY (at Royal College of Surgeons, Dublin), at 4.15.—Dr. H. H. Poole: The Use of Photo-Electric Cells in Submarine Photometry.

ROYAL INSTITUTION OF GREAT BRITAIN, at 5.15.—Prof. J. Barcroft: Some Effects of Climate on the Circulation (II.).

ROYAL SOCIETY OF MEDICINE (Medicine Section), at 5.30.—Prof. E. Leschke: Metabolism and the Sympathetic System.

INSTITUTE OF MARINE ENGINEERS, at 6.30.—D. M. Proctor: Steam Accumulation.

INSTITUTION OF AUTOMOBILE ENGINEERS (at Royal Society of Arts), at 7.—M. Platt: The Accessibility of the Pleasure Car Chassis.

INSTITUTION OF ELECTRICAL ENGINEERS (North Midland Centre) (at Hotel Metropole, Leeds), at 7.—Annual General Meeting.

ROYAL PHOTOGRAPHIC SOCIETY OF GREAT BRITAIN (Kinematograph Group), at 7.—C. Friese-Greene: Latest Improvements in the Friese-Greene Colour Process.

INSTITUTE OF METALS (North-East Coast Local Section) (at Armstrong College, Newcastle-on-Tyne), at 7.30.—Annual General Meeting.

WEDNESDAY, APRIL 29.

INSTITUTION OF ELECTRICAL ENGINEERS (South Midland Centre) (at Birmingham University), at 7.

ROYAL SOCIETY OF ARTS, at 8.—Dr. A. Balfour: The Trend of Modern Hygiene.

THURSDAY, APRIL 30.

ROYAL INSTITUTION OF GREAT BRITAIN, at 5.15.—F. Kingdon Ward: Plant Hunting on the Roof of the World.

CHILD-STUDY SOCIETY (at Royal Sanitary Institute) (Annual Meeting), at 5.30.—At 6.—Dr. C. W. Kimmins: Progress of Child Study in America.

INSTITUTION OF CIVIL ENGINEERS (Birmingham and District Association) (at Chamber of Commerce, Birmingham), at 6.

FRIDAY, MAY 1.

ROYAL INSTITUTION OF GREAT BRITAIN, at 5.—Annual Meeting.

SOCIETY OF CHEMICAL INDUSTRY (Manchester Section) (at 16 St. Mary's Parsonage, Manchester), at 7.—Dr. S. S. Zilva: Recent Progress in Vitamin Research.

ROYAL PHOTOGRAPHIC SOCIETY OF GREAT BRITAIN, at 7.—Pictorial Group.

JUNIOR INSTITUTION OF ENGINEERS, at 7.30.—A. A. Fairfax: Pumps and Pumping Problems.

GEOLOGISTS' ASSOCIATION (at University College), at 7.30.

PHILOLOGICAL SOCIETY (Anniversary Meeting) (at University College), at 8.—Presidential Address.

ROYAL SOCIETY OF MEDICINE (Anæsthetics Section), at 8.30.—Annual General Meeting.

ROYAL INSTITUTION OF GREAT BRITAIN, at 9.—Prof. W. L. Bragg: Crystalline Structure of Inorganic Salts.

SATURDAY, MAY 2.

ROYAL SOCIETY OF MEDICINE (Otology Section), at 10.30.—Annual General Meeting.

ROYAL INSTITUTION OF GREAT BRITAIN, at 3.—W. P. Pycraft: Use and Disuse and their Effect on the Bodily Structure of Animals (II.).

FREE PUBLIC LECTURES.

MONDAY, APRIL 27.

KING'S COLLEGE, at 5.30.—Prof. R. Chambers: Recent Advances in the Study of Living Cells. (Succeeding Lectures on April 28 and 29.)—Prof. R. Dyboski: History and Geography of the New Polish State.

WEDNESDAY, APRIL 29.

INSTITUTE OF PHYSICS (at Royal Society), at 5.30.—Dr. W. Makower: Physics in the Rubber Industry, with special reference to Tyre Manufacture.

THURSDAY, APRIL 30.

KING'S COLLEGE, at 6.30.—Dr. O. Vočadlo: The Czechoslovak Republic To-day: Geography of the State.

FRIDAY, MAY 1.

UNIVERSITY COLLEGE, at 11.—Prof. A. V. Hill: The Physiology of Muscle and Nerve. (Succeeding Lectures on May 8, 15, 22.)

KING'S COLLEGE, at 5.—Dr. A. W. Rogers: Physical Features of South Africa in relation to its Geological Structure and History. (Succeeding Lectures on May 8 and 15.)—At 5.30.—Prof. F. J. Cole: The History of Protozoology. (Succeeding Lecture on May 8.)