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Synthetic Study of Man

TO the contemplative mind any considerable gathering of men of science drawn from a variety of countries affords ample food for thought; but when that gathering is composed of anthropologists, as was the International Congress of Anthropological and Ethnological Sciences which met in London on July 30–August 4, there seems to be a peculiar propriety in its international character. It affords a working model, as it were, of the process of coming to an understanding of an alien point of view and mode of thought, which, we are told, it is one of the aims of certain branches of anthropological studies and their application in practical affairs to attain. If the good-fellowship, which was such a conspicuous feature in this anthropological congress, affords any criterion, either the discipline is eminently successful in attaining this one of its objects, or the anthropologist is exceptionally fortunate in temperament. For it must be recorded that this first meeting of the newly constituted Congress was, from every point of view, scientific or social, one of the most successful of the scientific congresses that have been held in London in recent years. To have gathered together for a week's discussion more than a thousand members drawn from forty-two countries—so far afield as Japan, China and South America, from every corner of Europe, as well as from the remotest parts of the Empire—was in itself no small achievement.

H.R.H. Prince George, who received the delegates, in declaring the Congress open, pointed out that a reunion of this kind has three main purposes. The members had come there, he said, "to review recent advances in knowledge . . . to compare your experiences and ideas; and to add something to our notions of what man is and what man does". He went on to say: "Above all, you are here to make the acquaintance of one another and to gain that knowledge of the personal equation which means so much in scientific work." Who will say that in this last remark His Royal Highness did not put his finger on the vital point which justifies, in the long run, the expenditure of time, money and labour entailed by the organisation of a congress on such a scale?

No man of science, it may be, but would endorse fully the value of the personal equation. It undoubtedly assists in the appreciation of the mode of approach in an attack on the larger problems of science, especially in those in which methods

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of exact measurement are not directly applicable; but it is rather in the intimate realisation of a common aim and a common pursuit of scientific truth that personal contact attains its fullest fruition. It assures that broad conception of science as an end in itself, to be pursued without regard to political opinion or national bias. It is, in fact, in the intimacy of those personal relations that warmth and colour are given to the recognition of the international standing of scientific inquiry and research, and it is one of the means whereby the aspiration that science should transcend national boundaries issues in practical effect.

In one respect the international congress enjoys an advantage—of a somewhat meretricious character, perhaps—over other gatherings for scientific discussion. In the somewhat capricious working of the dissemination of scientific news, it has a readier access to the public ear through the popular Press. It was no doubt with this at the back of his mind that Sir Grafton Elliot Smith, in his incisive opening remarks as president of the Section of Anatomy, put the case for the international congress admirably on both general and specific grounds, when he pointed out how the discussion of scientific problems for which it affords opportunity should serve to dissipate the misconceptions which are utilised to bolster up political propaganda. He went on to point to the specific instance which is now in the minds of all, the deliberate misuse in Germany of the term 'Aryan' in a racial sense, and its further distortion to the sense of 'non-Jewish'.

Time is demanded to weigh and digest the vast mass of material presented to the members of the Congress; and it would be premature to attempt any estimate of how far anthropological studies have been advanced by the proceedings. At the same time, it cannot be doubted that the discussions, such as that on the blood-groups, to which we refer elsewhere in this issue (p. 222), by defining terms or by isolating problems upon which further research must concentrate as a condition precedent to further advance, have helped to clarify ideas and in so far constitute a very real progress.

In one respect, however, it is possible to say emphatically that the Congress has served its purpose. Had it gone no further than the issue of its programme, it might without too great exaggeration be said to have advanced research materially. By their organisation of the proceed-

ings into sections for the presentation of communications, the promoters of this first meeting have laid down lines which define the scope of the science, and have propounded views of the inter-relation of the various departments of the somewhat amorphous study of man. For while it is generally conceded that the science of anthropology is concerned with all that man is as well as all that man does, in practice opinions differ widely both as to whether that definition is to be taken as all-inclusive in regard to subjects, and also as to how far and at what point, as for example in the investigation of social institutions, a special discipline, in this instance say sociology or economics, is to take over from the more generalised study.

The list of sections will be found *in extenso* on p. 222. It will be seen that four sections form a biological series in which problems of man's phylogeny and taxonomy, distribution and the mental qualities by which he is specifically *Homo sapiens*, are considered. Three sections are devoted to the description of peoples according to geographical distribution. Finally a group of four sections together covers man's relation with the material world and his methods of exploiting it—technology—man's relations with his fellow-men—sociology—and man's relations with beings of the other world—religions. The last section of this group deals with man's method of communicating with his fellow-men and with spirits—the section of language and writing.

By a wise convention, communications were not expected to range at large over the whole field, but were, if possible, it was suggested, to confine themselves to certain stated problems in each division of the subject. The organisers hoped in this manner to concentrate attention on the more urgent problems of the moment. Thus, in the Section of Anatomy among the topics put forward for discussion were the blood-groups as a criterion of race, certainly one of the most insistent subjects of debate in racial questions at the moment, and man's place among the primates. As a result, a well-directed consideration of the problem in each case ensued.

In these days specialisation is a necessary evil; but it is an evil that can be mitigated. It would, for example, have been welcome had a broader treatment of genetic questions in relation to the problem of race been possible. As it was, the eugenic issue alone was raised. It may well be that the synthetic view of the study of man, which emerges from the scaffolding erected by the

organisers of the Congress, will continue to affect the future orientation of investigation and may help to correct the over-emphasis which has been laid of recent years on certain aspects of cultural research.

It is another view of this same trend which would direct attention to the overweighting of anthropological study in the direction of primitive or 'savage' peoples. This is no new complaint. It has been pointed out frequently that man is still man although he may be civilised. The arguments about race, which are now being thrown out recklessly in certain quarters, show how little real understanding there is of the racial problem among European peoples—a fact, indeed, to which attention was directed by a resolution of the Section of Anatomy, pressing for intensive study of the question. When workers in the field were few it was the wise, and indeed the obvious, course to concentrate on primitive peoples who were dying out or changing rapidly; but in the interests of the general principles of the science, anthropologists can no longer afford to neglect the universal for the particular. Man must be studied as one, whole and undivided, as well as in part.

Now that the practical application of the results of scientific research enter largely into almost every feature of daily life, it is becoming increasingly apparent that, whereas formerly practical utility was a secondary consideration, and more often than not a by-product, of pure research pursued for its own ends, nowadays practical considerations vitalise scientific studies. This is not the whole story; but it holds good in anthropology (if not yet to the same degree), as, for example, in chemistry or biology. Just as the study of genetics has been and will continue to be essential to the agriculturist and breeder, so the study of race and of culture will be of paramount moment in the government and in the direction of the future development of man. Unfortunately, while this is, or should be, an article of faith with every anthropologist, it has not yet secured complete and general recognition.

This, however, is the lesson to be drawn from the wise remarks made by Lord Onslow in his presidential address to the Congress, when he contrasted the efforts of the nineteenth century to Europeanise backward peoples, with the teaching of anthropology to-day that the future development of such peoples must be built on the foundation of their own institutions. How far anthropology will be enabled to assist in this task will,

however, depend, as has already been said, upon its ability to formulate general principles and apply them to cases. That this exercise in casuistry, in the better sense, is not beyond exponents of the science is suggested by such communications as those submitted to the Congress by Prof. Arnold J. Toynbee and Dr. R. R. Marett, to make a selection which is in no sense invidious. Thus the Congress serves to point a moral, if a congress may be said to have a moral, that anthropology must see its problem whole; and, in that whole, practice, as well as theory, has a part.

The Agony of Knowledge

The Birth of the Future. By Ritchie Calder. Pp. xiv+298+9 plates. (London: Arthur Barker, Ltd., 1934.) 10s. 6d. net.

MR. RITCHIE CALDER, in this work, tells us of a pilgrimage he has undertaken "into those strange places where the world of the future is being born—the scientific laboratories of to-day". We wonder! At least, we doubt the "being born". To some of us, it seems more likely that our world is very old and maybe running down: science, indeed, is seemingly but a new ribbon road leading us to still faster destruction, with new buildings arising on either side which more and more obscure natural beauty: in large measure, it is a 'wash-out': scarcely anywhere can an economic crop be grown without fertilisers; few have yet considered what the political consequences of this state may be.

I recently had the opportunity of visiting the noted caves at Altamira, a taxi-drive out of Santander, Spain. We there saw the remarkably finished, almost life-sized drawings of animals, in black and red ochre, set out upon the nearly horizontal roof of the cave. The anthropologists aver that these are at least twenty thousand years old. The cave, to-day, is lit up electrically; we are not aware by what light the artist worked and what opportunities the cave-dwellers had of seeing his efforts illuminated. What was so striking at Altamira, to a visitor like myself, was the grim contrast between art and electricity: the one so old, the other so new—scarce a century old: in fact, its use has been developed under my own eyes. During the interval, since the cave drawings were made, art probably has made little advance and art feeling too; both are everywhere more or less decadent and untrue to-day,

displaced by the machine: yet the whole world is under the control of electricity, although this only began its travels abroad in 1866, the year in which the first successful Atlantic cable was laid by the *Great Eastern*—a ship I saw upon the stocks. Whilst developing and worshipping the machine, man is doing little to develop himself: he remains very like the Altamiran artist. In fact, he is giving no scientific thought to his own upbringing. This, popular writers are beginning to point out, none too soon:

“If we were one-half so clever in the matters that lie far outside machinery as we are about machinery itself, what people we should be and what a world we should leave our children. I have no doubt that boys and girls in Coventry are comparatively well looked after but nobody has attended to them as their fathers are attending to the proud young *Double-Six-Daimlers*.”

So writes Mr. J. B. Priestley in his “English Journey”, in giving an account of his visit to the highly organised motor-car works at Coventry. The comparison is one that should put school-masters and education authorities to shame. The conscious care lavished upon the machine has no counterpart in the treatment of the up-growing child!

Mr. Priestley raises an equally important social issue in describing his experience at Lincoln. After visiting the cathedral at the top of the hill, where scientific thought has no place, he goes to an engineering works below where he sees a giant *steam digger* in course of construction. Eventually, directed by a single man and fed only with petroleum, this will do the work of 800 navvies. Charity may be preached upon the hill-top; no thought of practising it prevails at the bottom. Men are fast being made unnecessary: we shall soon need only a man or two here and there—machines will do the rest; society will be like the big fish to be seen at the British Museum (Natural History), with a small male grown to her side. Where is such ‘progress’ to stop? Great is the engineer, but can we allow him to prevail exclusively, the slave of commerce and industry?

In various countries, millions upon millions are being held in almost helpless subjection by a few dictators: because of the engineer, who has furnished them with the machine-gun. In last resort, this commands the world to-day.

The League of Nations has done little else but keep the sore of military war alive: the root causes of international difference are in no way considered.

A small island nation, without command of machinery sixty years ago, is now at commercial war with all other countries—and succeeding—largely with the aid of machinery we have supplied. All the world to-day is in seething discontent, owing to the lop-sided development of mechanical enterprise and our failure to raise the general level of human intelligence—to use our knowledge except to commercial ends. It is easy to chortle in our joy over present scientific achievement, but what of the future?

Think of the unconscious work done, after the father has placed his order, by the mother in fashioning the child—work of infinite complexity, of infinitely greater delicacy and difficulty than any that is involved in any machine that is consciously made by human hands. Once born, however, apart from the perfunctory brute affection she lavishes upon her offspring, the intellectual care she takes of the child is little more than intuitive and superficial. She has little, if any, technical training for her office and is without knowledge both of her own and of her child’s mechanism. The father is even more ignorant and considers that his duty is done when he sends his child to school, without thought of consequence: there training is given for the forum but not for the market-place.

The ‘Double-Six-Daimler’ would soon be on the scrap-heap, if treated as is the human child. Yet we are excited because deaths from motor accidents on roads occur at the rate of about 180 per week. Though we are beginning to complain of the garages in which human beings are being lodged, there is no public conscience as to their general treatment, mental, moral or physical: millions lead maimed lives in consequence. Man may be a tool-using animal—he shows this by the marvellous way in which he flies—but he is nothing more: he has no developed thought for his own immediate interests, for either his body or his soul. No scientific effort is made by the schooling class to fashion those who are its slaves during the impressionable years of life.

The writing on the wall is there, if we will but see it—in the Crystal Palace, the Great Exhibition of 1851, fathered by Prince Albert. Appropriately made of glass, it stands to-day a transparent monument of failure: its iron ribs, made of puddled steel, wonderfully resist decay—as do ours; still, unless acid, water and air can always be kept from them, they are doomed to perish—their life depends upon the protection of paint the

owners can afford to give. In 1851, we were all but at the peak of our commercial industrial prosperity—only the introduction of steel, especially in shipbuilding, delayed the rapid fall of the curve. We had arrogantly supplied the whole world and ignorantly thought—if we thought at all—that we could continue to live at the expense of the outer world: to-day, the outer world will scarcely look at us; moreover, what is true of ourselves is true of every other industrial nation: each has a similar surplus. We all have to reconsider our modes of living and learn, if possible, to live together. Unless we apply to the ribs of society the paint of rational training, nothing can prevent their rusting away.

The social shoe pinches in not a few other directions. With all our boasted scientific progress we have only begun to think with intelligence about our food during little more than the past twenty years. The public generally take little interest in the subject—far less than formerly. In her recent interesting book of reminiscences, "A Backward Glance", Mrs. Wharton, a well-known American author, at the close of an interesting account of her home life, in which she speaks most highly of the devoted and skilful service rendered by mulatto cooks, writes as follows:

"I have lingered over these details because they formed a part—a most important and honorable part—of that ancient curriculum of housekeeping which, at least in Anglo-Saxon countries, was so soon to be swept aside by the monstrous regiment of the emancipated: young women taught by their elders to despise the kitchen and the linen room and to substitute the art of acquiring University degrees for the more complex art of civilised living.

"The movement began when I was young and now that I am old and have watched it and noted its results, I mourn more than ever the extinction of the household arts. Cold storage, deplorable as it is, has done far less harm to the home than the Higher Education."

Perhaps the new Wine and Food Society will do something to stem the debacle. The fear is, that the modern development of flat life and motor-scouring may lead to harmful modes of feeding; the prospect is all the more serious now that we are told by statisticians that forty or so years hence we shall have a population of 33 millions, not as Carlyle said, 'mostly fools', but mostly old women. The consequences of misfeeding women have not been taken into account: if not fatal, they may influence unpleasantly the general out-

look of those old ladies. We cannot safely allow anything and everything, drugs in particular, to be advertised into use: the legitimate use of advertisement is a subject we greatly need to consider.

As to cold storage and higher education, which Mrs. Wharton feelingly links together, the gift of the former, looked at from any other than the commercial side, is probably a doubtful blessing: even commercially, it has two aspects, as it favours foreign competition. What is saved on the roundabouts of supply may be lost on the swings of quality. When we know what is food, we shall be able to discuss the issue scientifically. The argument applies equally to food preservation by canning. That dog 'Science' has a strange way of going mad to serve commercial ends and spitefully biting where it should bless.

The "Higher Education" to which Mrs. Wharton refers is another subject calling for scientific treatment. This has been undertaken from the beginning in a wrong spirit—in a spirit of rivalry. Women have mostly sought to show that they can do what men do, not to improve their power of doing woman's work. Fortunately, of late, there has been a tendency on the part of the leaders to recognise that the pendulum has swung too far away from the woman: unfortunately, we have allowed the debasing influences of Hollywood to poison the female mind, and the Church has long failed to exercise any moral control. This failure also we shall need to study scientifically, in shaping the future of our world. The nation is in danger of being entirely misled by the Department of Scientific and Industrial Research, which is shaping inquiry all but entirely along commercial lines. Research in natural science can take care of itself: what we really need to foster is inquiry into the application of scientific method to the moral and social development of the masses. The girls are everywhere turning out the boys, whilst neglecting their own work. At least, we shall be forced to train the boys to girls' work—which will be a modern development of the *Couvade*. Society cannot allow boys to become hooligans, through lack of work and idleness. We know already that kitchen work might be better done by them: at least, with more circumspection. If feeding ourselves properly and so giving ourselves healthy, happy lives be the future chief task of society, as it will be, domestic service will be the highest form of social service: chemists will be trained in the universities to be real cooks, for service, not merely to play about with *Deuthydrogen* and

electrons. Some use must be found for intelligence : the kitchen makes most demand. Men are too intelligent only to operate machinery—women ask to be made parts of a machine. The chemist alone can grasp the influence of structure upon function and understand that mentalities must differ. 'Beilstein' is an embodiment of our human nature : only those who understand 'Beilstein' will grasp the complexities of human nature.

As yet we have put no scientific thought into our affairs. In a terminal essay on "The Practice of Diplomacy", at the close of his remarkable work on "Lord Curzon", Mr. Harold Nicholson writes in a way to show that this is becoming clear even to statesmen :

"The present impotence of individual statesmen is not solely due to the rise of democracy but must also be ascribed to the greater complexity, the increased interdependence, of the factors which they endeavour to mould. Mussolini is no less unfettered than was Cavour ; Hitler is even more unhampered than was Bismarck. Yet their capacity for creative action is limited by the fact that no modern problem can possibly be self-contained. Human affairs are no longer manageable by a single individual will, nor can they be comprehended as a whole by any single human intelligence. They have outgrown the capacity of any individual brain. Statesmanship henceforward will have to be a corporate and not a one-man business."

The Germans long ago recognised and applied this doctrine : hence their great industrial success before the War. The Japanese are also making use of scientific method in their affairs. Here, no systematic account is taken of knowledge and experience. Hazlitt long ago discoursed on the "Ignorance of the Learned". Probably, no class to-day is so ignorant as the teaching class : so thoughtless ; so unmethodical ; so blind to the changes in society brought about by the application of the art of scientific inquiry. Lord Fisher's advice was sound : either we scrap the lot or we perish, not from lack of knowledge but from failure to use it. Bows and arrows are the present armoury of the schools : we have to change these for long-range weapons.

If the class of labour employed in making machinery had been as uninventive, as insufficiently trained and as unskilled as is the great mass of that engaged in fashioning the human machine, there would have been little flying and few high speed records of any kind.

Mr. Ritchie Calder's book is the work of a super-enthusiast, who has persuaded himself into be-

lieving that he has a mission. Unfortunately it is written in the snappy, sensational style favoured by a section of the Press to-day : it is not literature, in any proper sense of the term. Such an account necessarily lacks feeling and is uncritical. The spirit behind the work of scientific inquiry cannot be brought to the fore by such writing : the book therefore does not help the young idea to shoot. Nonetheless, it will be full of interesting matter to many. The good points are well brought out in a foreword by Sir F. G. Hopkins, the president of the Royal Society, who dwells especially upon Mr. Calder's expressed conviction that no cure will come for the illogical state of our world until the methods of scientific thought are introduced into the conduct of public affairs.

Sir Gowland Hopkins makes the all-important statement that it is his "personal belief that scientific opinion should be organised in this country and so organised that when it is expressed upon matters within its competence, it should be with such authority that no government or legislative House could ignore it". Far more is needed : the introduction of the spirit of scientific method and the spirit of scientific inquiry into all public affairs. I imagine these are practically unknown in the commercial world : this could not otherwise be so entirely averse from all use of standards of value and given over to speculation as it is.

It is in Sir Gowland Hopkins's power to effect his projected organisation almost by a stroke of the pen—by organising the fellows of his Society into a consultative body. These physicians must learn to heal themselves, in the first instance : they must study the method they themselves use, often unconsciously. They must co-operate in bringing the nation under the rule of scientific method. This may involve a bitter struggle against our human nature.

No other course will suffice. The Society itself may need some modification, in order that it may have the necessary width of outlook. To this, no objection can be taken. It no longer serves any necessary, useful purpose as a Society for the publication of the results of scientific inquiry. Unfortunately, since the War, it has largely abrogated the functions it formerly exercised as a consultative body, the body scientific to-day having lost most of its public spirit, being overcome by speculation and the blind worship of so-called research : without regard for educational efficiency.

HENRY E. ARMSTRONG.

Applied Spectroscopy

(1) *Spectroscopy in Science and Industry: an Introductory Manual describing its Applications to Industrial and other Practical Problems.* By Dr. S. Judd Lewis. (Blackie's "Technique" Series.) Pp. vii+94+10 plates. (London, Glasgow and Bombay: Blackie and Son, Ltd., 1933.) 3s. 6d. net.

(2) *Metallurgical Analysis by the Spectrograph: being some Experiences of the Application of the Spectrograph to the Analysis of Non-Ferrous Metals and Alloys.* By D. M. Smith. Pp. xi+114+10 plates. (London: British Non-Ferrous Metals Research Association, 1933.) 10s. 6d.

(3) *Optische Messungen des Chemikers und des Mediziners.* Von Dr. Fritz Löwe. (Technische Fortschrittsberichte, herausgegeben von Prof. Dr. B. Rassow, Band 6.) Pp. xii+205+4 plates. (Dresden und Leipzig: Theodor Steinkopff, 1933.) 9 gold marks.

(1) **T**HERE must have been little thought of industrial application of the first important spectroscopic investigations more than two hundred and fifty years ago. To-day there can be few industries of any importance that fail to make use of the spectroscopic method in the control of products, whether they be metals, food-stuffs or medicines.

Dr. Judd Lewis's book differs from the other two under review in that it devotes rather more space to elementary principles. Besides giving the reader a very good idea of the meaning of spectra and the various instruments used for analysis, the methods of detecting impurities in different samples are set out very clearly. In addition to the discussion of the internal-standard method and the ratio-quantitative method, one would have liked to see a little more about the *raies ultimes* method originated by de Gramont. The chapter on industrial and scientific applications of emission-spectrum analysis is followed by others on spectrophotometry, absorption spectroscopy; and very brief mention is made of Laby's method of using the X-ray emission spectra: the work of Hevesy along the same lines is not mentioned. The inclusion of ten plates of spectrum photographs adds to the value of this little book, which should be of use to all physicists and chemists who require a good straightforward introduction to applied spectroscopy. H. G. J. Moseley's name on page 88 is misspelled.

(2) Mr. D. M. Smith's monograph stands in a

rather different category. The outlook is narrower, but the treatment is much more complete. Mr. Smith is largely concerned with the analysis of non-ferrous metals and their alloys. After introductory chapters on general principles, the spectrum and its photography, qualitative analysis and technique, we are given a discussion of the various methods of quantitative analysis. The internal-standard method originated by Gerlach is well explained, and the various photometric methods for the quantitative estimates of line intensities are given. Valuable sets of tables, accompanied by well-reproduced plates, illustrate the use of the internal-standard method in spectrographic assays of zinc, tin, lead and copper.

The book has been written almost entirely from the practical point of view, and is everywhere full of useful information for the practising spectroscopist. In addition to the usual index, there is a valuable bibliography of more than a hundred useful books and papers.

(3) Dr. Löwe, who is a section superintendent of the Zeiss works, is in a unique position to describe the design and applications of optical instruments. His first-hand knowledge has been used to good advantage in this book, and it is therefore perhaps ungrateful to grumble at the lack of illustrations of instruments designed in countries other than Germany. The treatment is rather more detailed than in Dr. Judd Lewis's book; the number of instruments described is considerably larger and some attention has been paid to grating instruments. It may perhaps be doubted whether the grating spectrograph with its feebler intensities is as useful to non-physicists as the more usual prism instruments. The author has not limited his treatment to purely spectroscopic matter, and in addition to the usual photometric methods for the determination of line intensities we are given sections on colour determination in liquids, fluorescence measurements, and turbidity measurements as applied to chemical and medical problems (nephelometry).

Very interesting are the sections on the applications of refractometric measurements in various problems of technical chemistry. Important subjects treated in this part of the book are oils, fats, sugars and starches, beer, pepsins, blood serums and milk. A final chapter deals with the uses of interferometry in problems of gas mixtures and solutions. Here again one may perhaps doubt whether the busy chemist will take the trouble to make use of this rather difficult branch

of applied physics. Surely in a book of this kind the reader should be given some account of the uses of polarimetry? Dr. Löwe has unaccountably avoided this subject. Perhaps he will repair the omission in a later edition.

Many valuable numerical tables are included in the book, which is well printed and contains a good index.

Primitive Fossil Fishes

British Museum (Natural History). *The Cephalaspids of Great Britain*. By E. A. Stensiö. Pp. xiv + 220 + 66 plates. (London: British Museum (Natural History), 1932.) 60s.

THE Cephalaspids are among the oldest fossil fishes which are known by nearly complete specimens. They are found in the Upper Silurian, Downtonian and Devonian fresh-water deposits of Europe and North America; and they seem to have lived on the bottom like certain modern Siluroid fishes, which they much resemble in outward shape. They are specially important because the fossils exhibit not only the external armour, but also enough of the internal skeleton of the head and branchial region to reveal the arrangement of many soft parts. They thus make it possible to discover some of the fundamental characters of fishes in their beginning.

The best-preserved heads of Cephalaspids hitherto known are from the Downtonian rocks of Spitsbergen, and have been described in astonishing detail by Dr. E. A. Stensiö, of Stockholm. With these heads, however, there are rarely any fragments of the trunk. Dr. Stensiö has therefore now undertaken a study of the Cephalaspids from the Downtonian and Lower Devonian formations of Great Britain, in which the trunk is often present and sometimes well preserved. The structure of the head could not have been satisfactorily discovered from the British specimens alone, because in these the internal parts are less well ossified and fossilised; but the dermal armour of the trunk and fins is almost completely displayed, and admits of detailed study and comparison.

Dr. Stensiö's results are published by the British Museum in one of the most sumptuous volumes ever devoted to a group of fossils. They are illustrated by sixty-six plates of unusually clear photographs, which have been obtained by specially devised methods; they are also explained by numerous diagrammatic figures in the text.

In the chapter on anatomy, which extends to seventy pages, Dr. Stensiö interprets the British fossil heads by reference to the specimens from Spitsbergen, but adds new observations on the irregular vascular canals in the middle layer of the shield, which he thinks are supplemented by an elaborate system of mucus-producing canals in a more superficial layer. He also considers that the appearance of separate polygonal plates in the head-shield is due to the impress of a coarse network of mucus canals, distinct from the ordinary sensory canals which sometimes leave simple linear impressions on the surface. At the same time, he points out that the "radiating vascular canals" and the "ring-sinus" which mark the edge of the polygonal areas in the head-shield, are seen again at the lines of junction in the transverse rows of scales on the trunk. His interpretation of the polygonal areas may therefore be wrong.

All satisfactory observations, however, confirm the conclusion that the Cephalaspids belong to the same great primitive group as the modern lampreys and hag-fishes, which are merely degenerate survivors. It is thus interesting to note that along the trunk in *Cephalaspis* itself, and in some other genera, a pair of ridges supported by simple scales seem to represent continuous paired fin-folds, of which the scaly pectorals form the only enlarged and differentiated portion. At least, the scales supporting these ridges are very like those which obviously represent the anterior dorsal fin in some genera. The Cephalaspids, indeed, so far as known, are almost ideally archaic fishes.

The systematic descriptions occupy half of Dr. Stensiö's volume, and he recognises many more species than have hitherto been admitted among the British Cephalaspids. He also adds two genera. He makes less allowance than previous authors have done for imperfections in the fossils due to crushing and fracture, and for possible changes during growth. Only experience in the naming of future discoveries can show whether his elaborate scheme of classification is justified. He has received valuable help from Mr. W. Wickham King in determining the geological distribution of the various forms.

Dr. Stensiö and the British Museum are indeed to be congratulated on this imposing contribution to our knowledge of British fossils, but one wonders what will be the extent of a palæontologist's library in the future if each little group is treated in a similar manner.

A. S. W.

Short Reviews

The Chemistry and Physics of Clays: and other Ceramic Materials. By Alfred B. Searle. Second edition, revised and enlarged. Pp. xvi+738. (London: Ernest Benn, Ltd., 1933.) 55s. net.

THIS is the second edition of a book first published ten years ago. The same main divisions and chapter headings are again employed, although much of the contents has been rewritten to include a selection of the vast body of work published in recent years. The physics and chemistry of ceramic materials covers such an extensive ground that it is impossible for any one man to deal completely with it, or even to maintain exactly the same perspective in its different sections; specialists in each of the numerous restricted fields included in this book will, no doubt, find points for criticism. But ceramists, for whom it is primarily intended, are not immediately and directly concerned with current theories; they require information and guidance on practical points, and if they obtain a successful rule-of-thumb from some hypothesis that is incomplete or even wrong in some important particulars, their immediate need is satisfied. When the rule-of-thumb breaks down—as *ad hoc* solutions inevitably do, sooner or later—the theorist and the practical man are supplied with another point of reference for a more complete theory.

The author disclaims any intention of providing a critical scientific discussion of current theories, on many of which, indeed, there is wide disagreement; instead, he has merely retained a sufficient theoretical background against which the facts and processes of the ceramic art can be displayed. There is no doubt that the current and immediate future needs of the ceramists are best met by this arrangement and, to judge from the results of a number of test questions the reviewer put to the book, the author has fairly covered his embarrassingly wide subject.

The Human Problems of an Industrial Civilization.

By Prof. Elton Mayo. Pp. vi+194. (New York: The Macmillan Co., 1933.) 8s. 6d. net.

PROF. ELTON MAYO approaches the human problems of to-day through a study of 'fatigue'. He shows that although it was once considered "a simple and special study", it is now known to embrace so wide a sphere as to make simple definition hopeless. He traces the development of industrial psychology along these lines in Great Britain, and pays tribute to the important and penetrating work of British investigators.

Several interesting experiments and investigations in an American factory are described in detail, and the gradually increasing round of problems leads to consideration of sociological problems and a conception of the 'new administrator'. Prof. Mayo concludes that the primary need of the industrial world is to develop a

technique that will enable people to live in easy social relationships with each other. At the same time, every individual should have the right to feel that he is of economic value to the community. The whole of this most important aspect of human nature we have recklessly disregarded in our "triumphant industrial progress".

The book is excellent in that it shows psychological insight and wide reading, combined with sociological purpose.

The Fresh-Water Algae of the United States. By Prof. Gilbert M. Smith. Pp. xi+716. (New York and London: McGraw-Hill Book Co., Inc., 1933.) 36s. net.

UNTIL the appearance of this volume, there was no recent work available on the algal flora of the United States. Its appearance thus marks a distinct advance in botanical literature and the more so as the North American genera of algae are mostly represented in Europe and hence are of great interest to students in Great Britain.

The volume describes the characters and morphology of all genera of fresh-water algae found in the United States and of the closely related forms present in the salt lakes. Species are not specially described, although characteristic and common ones are indicated and illustrated. All the genera are illustrated, and the illustrations, although occasionally somewhat generalised, are exceptionally clear. A notable and valuable feature of the work is that the keys are based, so far as possible, on vegetative characters, a method of great utility to the average worker. Altogether this is a book to be recommended to those interested in algae.

Les textiles anciens du Pérou et leurs techniques.

Par Raoul d'Harcourt. Pp. 170+108 plates. (Paris: Les Éditions d'Art et d'Histoire, 1934.) 180 francs.

IN this volume the author, who has already published a work dealing with more general questions relating to the ancient textiles of Peru, is concerned only with technique. In addition to his description of the various methods of producing the patterns by variation in the interweave, as described from the examination of the fabrics themselves, he has given a section dealing with embroidery. The methods described have been tested by the author in practice.

The technique of the Peruvian textiles appears to have attained an advanced stage at an early date. There is little variation throughout the whole pre-Inca period, that is, according to Kroeber's chronological estimate, so far back as the beginning of the Christian era.

The fabrics are illustrated in a lengthy series of admirably reproduced plates, each of which is accompanied by a detailed description.

New Acoustics Laboratory at the National Physical Laboratory

By DR. G. W. C. KAYE, O.B.E.

ONE of the great social inconveniences in present-day life for large numbers of people is the lack of quietness which modern building design and materials have brought in their wake. The problem is accentuated in the case of the many large blocks of flats and apartment houses which are being erected, all around us, whether for the well-to-do or for the slum dweller. The question of acoustic isolation for the occupants receives

for little or nothing. Unfortunately, the present tendency in building is to cut down both weight and thickness, and so for greater silence we must turn to composite structures, in which case design becomes all important. Such designs can only be appraised experimentally, for at present we cannot predict quantitatively their performance from a knowledge of their structure. Much remains to be done, but already designs are available, for example, of light, double air-spaced partitions, which are much more effective sound-proofers than single partitions of the same total weight. Cross-ties and incorrect separation of the components may be fatal to efficiency. This is illustrated by recent work at the National Physical Laboratory on double windows, which indicates that the separation for ordinary window glass should normally not be less than 4-6 inches, and that at smaller distances the insulating value drops to a minimum which may actually be less than that of one window alone. Apropos of windows, sound insulation is often quite incompatible with open windows, and forced ventilation may be the only solution in such cases.

When we come to deal with noises or vibrations which reach a room via the structure of a building, quite different measures are necessary. Vibrations may often be arrested near the source by resilient undamped devices so loaded as to be of suitably long period. Modern building structures contain noise-transmitting components of a high order—whether steel framework, ferroconcrete, cement-bound brickwork, hard plaster, water

and radiator systems, sanitary piping, etc. Some form of discontinuity to arrest transmission has to be introduced, and in many cases the problems have still to be solved. Almost all forms of concrete flooring are noisy, and attention is now being given to floating floors, suspended ceilings and various types of floor finishes, to find an effective, yet economically feasible, solution.

The last stage in the attaining of a quiet room is to deal with extraneous noise which has succeeded in gaining admission or which is generated within the room itself. Something can be done to remedy the deficiency of absorbents in a too reverberant room by adding upholstery, curtains, thicker underfelts to carpets and so on. If these things are not in keeping with a room, then we can apply to the walls or ceiling one or other of the absorbents now commercially available, for example, fibre boards or porous plasters,

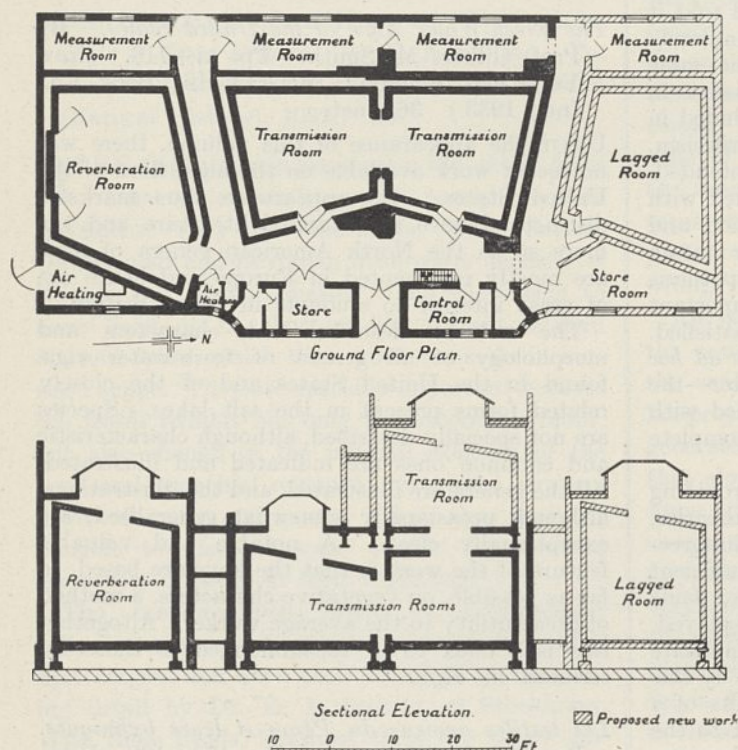


FIG. 1. New Acoustics Laboratory at the National Physical Laboratory.

little or no attention in the majority of cases, and it is a common source of complaint that purely local noises can be heard throughout the length and breadth of large buildings constructed on modern lines. Yet architectural acoustics is no longer shrouded in mystery and empiricism, but is a science of which some of the physical principles are well established, and the practical outcomes are often predictable. A good deal can, in fact, be done to mitigate the noise nuisance in buildings. The policy of perfection is, of course, to stop or lessen the noise at its source, but this may often be quite unfeasible. Alternatively, we must erect some kind of sound-proof barrier, whether wall, window or floor, between ourselves and the noise.

In the case of sounds which arrive by air, the sound-proofing value of a single homogeneous wall or partition is wholly a matter of weight. High notes are easier to stop than low, but design counts

or one of the hair or asbestos felts covered with perforated or pin-pricked fabric which can be dis-tempored or otherwise decorated. The effectiveness of the latter is noteworthy in that the area of the pin holes may be only a small fraction (less than 1 per cent) of the area of the fabric.

The foregoing will give a notion of some of the acoustical problems which confront the architect, the building industry and the acoustical engineer. It is not impossible that measures to reduce noise to the level demanded by the public may necessitate serious modifications in the accepted methods of construction. Adequate facilities for carrying out investigations on full-scale floors and partitions have not hitherto existed in Great Britain, but the Department of Scientific and Industrial Research has recently embarked on a programme of research, and a start has been made to provide the necessary facilities in the shape of a new acoustics Laboratory which has been designed at the National Physical Laboratory, with the co-operation of H.M. Office of Works.

The laboratory, which was open for inspection on the occasion of the annual visitation on June 26, will ultimately form part of the Physics Building. Complete acoustical and electrical isolation is aimed at in the case of the experimental rooms, these at present comprising a reverberation room and a pair of transmission rooms, each with its own measurement room for the operator during the actual observations. Fig. 1 shows a sectional plan and elevation. As will be seen, the enclosing walls, floors and ceilings are of massive masonry, and everywhere double, the inner shell being completely independent of the outer and resting only on insulating piers on separate foundations. The insulation in the piers is slab cork, and provision has been made for the hydraulic lifting of the inner rooms (which weigh 150-200 tons) so that should the cork deteriorate under the sustained heavy load it can be renewed.

Acoustic absorption coefficients have been determined in temporary accommodation at the Laboratory for some years, but unique facilities for the work are now provided by the new reverberation room. This is asymmetric both in plan

and elevation: the walls are not parallel nor is the ceiling horizontal, thus assisting in minimising the influence of the natural transverse resonances of the air in the room, as well as promoting the uniform and random distribution of sound which the several reverberation formulæ postulate. The even distribution is furthered by the use of a warble note as a source of sound. The walls of the room are finished in painted hard plaster, and the

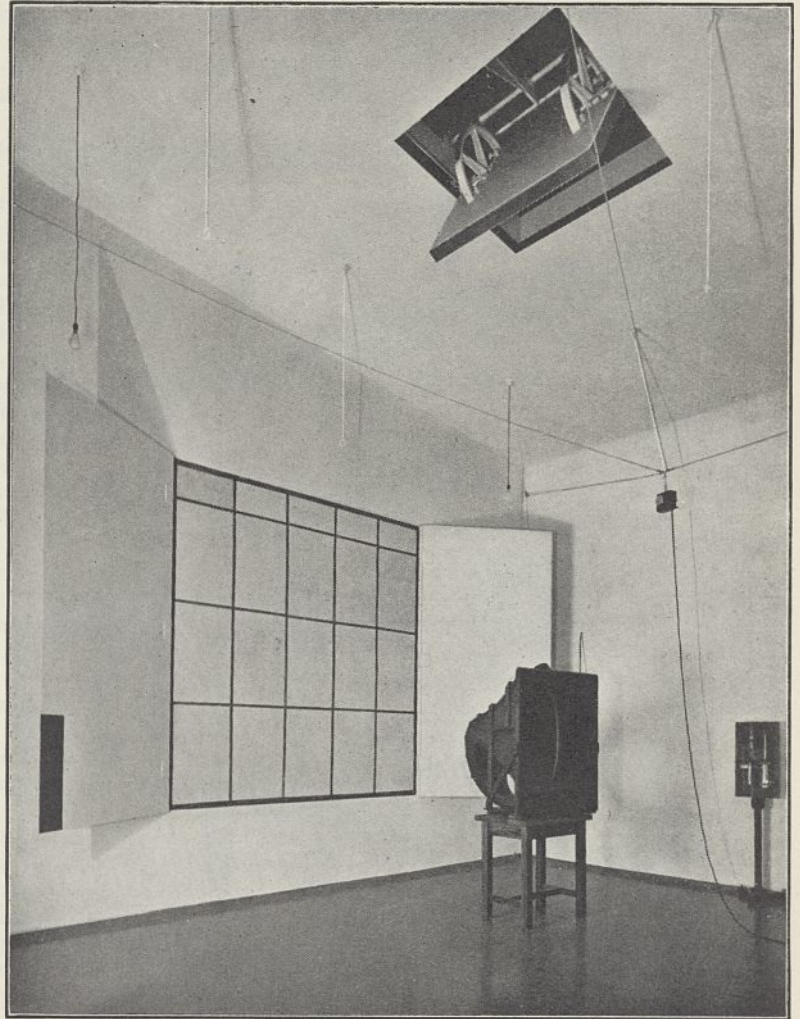


FIG. 2. Reverberation chamber showing loud speaker, microphone and test panel of which the acoustic absorption coefficient is required.

closely-fitting double entrance doors are each of solid steel, the inner being $3\frac{5}{8}$ in. thick and the outer $2\frac{1}{2}$ in., and correspond in superficial weight to the adjacent walls. The shutters to the skylight, which are of similar construction, are electrically operated from below.

The volume of the room is about 10,000 cubic feet, and the Sabine reverberation period for a note of 512 cycles per second is about 13 seconds when the room is empty. In one of the walls are steel swing doors (see Fig. 2) covering a shallow recess in which is mounted 100 square feet of the

material, the acoustic absorption coefficient of which is required. A loud speaker produces one of a range of notes of frequencies from 125 to 4,000 cycles per second, and in each case a microphone and amplifier system affords the decay curve of the average intensity in the room with the test absorbent alternately exposed and covered up by the doors. A thyatron relay device automatically records the decay period for any pre-

foundations, and are of the same irregular shape and general construction as the reverberation room, except that the entrance doors are triple and of solid wood. The test aperture, which is shown in Fig. 3, will take specimens up to about 10 ft. \times 8 ft. These are either erected *in situ* or assembled elsewhere and then mounted in position by the aid of the clamps shown. A runway is provided for transporting heavy specimens. Tests

are normally conducted with an exploring microphone in each room and a loud speaker in one of the rooms, a warble note with a selection of frequencies between 100 and 4,000 cycles per second being employed. The position of the microphone can be controlled from the adjacent measurement room and the oscillator exciting the loud speaker together with the microphone and associated amplifier are wholly operated from the electric supply mains. Provision is made so that the walls of the rooms can either be used in a reflecting state, when tests are made with sounds at random incidence, or covered with absorbent when a beam of sound is used. The rooms can readily be adapted for testing the sound attenuation in ventilation ducts and silencers as well as for studying the quietening of machinery.

The ventilation of the building is by pressure feed, and constant-temperature heating in the experimental rooms is aimed at by passing warmed air between the double walls. Concentric cable is used in the wiring of the experimental equipment, and when desired, the entire building or any selected section of it can be rendered electrically isolated by cutting off all external power supplies, requirements being then met from a battery.

It is hoped that it will not be long before an upper transmission room is erected (see

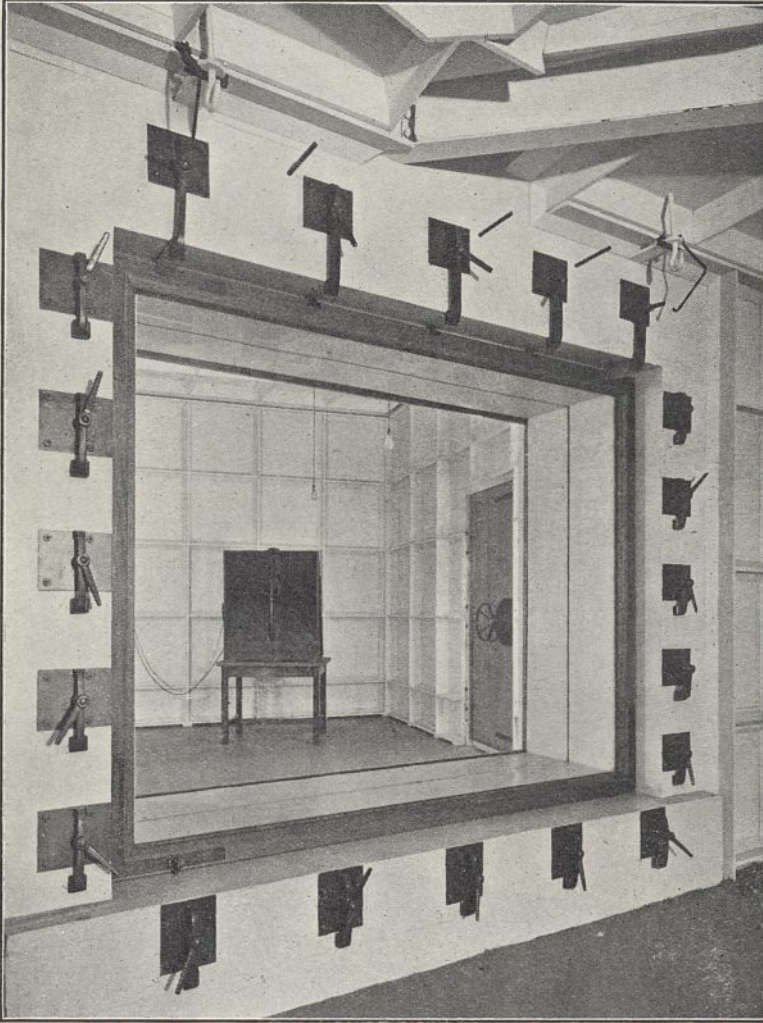


FIG. 3. Transmission rooms showing test aperture for measurement of acoustic isolating values of walls and partitions.

selected intensity drop of decibels. If the air of the room is appreciably humid, it may contribute markedly to the absorption of sounds of frequencies above about 2,000.

The values of absorption coefficients are known to be susceptible to a variety of influences and the Laboratory is participating in an international inquiry into the dependence of absorbing power on the size, shape and distribution of a test material, its thickness and porosity, the method of mounting, the degree of separation from a backing wall and so on.

The two transmission rooms are on independent

Fig. 1) so as to permit acoustic tests on floors for which provision has been made by constructing a ceiling aperture to take floor specimens 8 ft. \times 7 ft. and upwards. In the meantime, provisional arrangements are being contrived. A room with heavily lagged walls is also contemplated to provide for the absolute calibration of microphones and other purposes. The investigations in the new Laboratory will be implemented by 'field tests' on actual buildings so as to take into account the factors of construction and workmanship.

Annual Meeting of the Royal Society of Canada

THE Royal Society of Canada held its annual meeting on May 20-24, at the Chateau Frontenac, Quebec. Appropriate to the occasion of the fourth centenary of the discovery of Quebec, the president, M. Léon Gérin, delivered an address on "Jacques Cartier, notre découvreur". At the same meeting, the Flavelle Gold Medal was presented to Prof. L. V. King for his contributions to mathematical physics, the Lorne Pierce Medal for achievement in literature to F. P. Grove, and the Tyrrel Medal in historical subjects to J. C. Webster.

At the meetings of Section I (French Literature, History, etc.) eighteen papers, and of Section II (English Literature, History, etc.) sixteen papers were presented.

Prof. F. M. G. Johnson, professor of inorganic chemistry in McGill University, was president of Section III (Mathematical, Chemical and Physical Sciences). Owing to the fact that 161 papers were presented, the section was divided into three sub-sections, which met simultaneously in different rooms. Only a few papers of general interest were presented to the joint meeting of the section. Dr. J. S. Plaskett and J. A. Pearce gave a paper in which new evidence was presented indicating that our galaxy is similar in dimensions and structure to the Great Nebula in Andromeda. New concise methods for the rapid transformation of partial second derivatives in thermodynamical problems were presented by Prof. A. N. Shaw. Sydney Sillitoe gave the results of a series of measurements of reflections from the ionosphere using a new automatic method of tuning the antenna of the transmitting circuit which produces a sharp symmetrical wave pulse that was received on the usual type of cathode ray recorder situated two miles from the transmitter.

Among the papers presented by Prof. E. F. Burton and his collaborators, mention should be made of one on supraconductivity in which it was shown that films of supraconducting materials, when coated with thin films of non-supraconducting metals on the outside, lose the power of becoming supraconducting. R. W. McKay presented the results of a long series of careful measurements on the dielectric constant of conducting solutions of sodium chloride, copper sulphate and magnesium sulphate for a frequency of 2×10^6 . A new method of quantitative micro-analysis was given by Dr. J. S. Foster and G. O. Langstroth, in which quantities of lead of the order of 10^{-8} gm./c.c. were measured in the spinal fluid.

In the Mathematics Sub-Section, Prof. L. V. King presented papers on acoustic radiation pressures on spheres which gave an adequate explanation of the dust figures observed by Prof. R. W. Boyle and his collaborators in the neighbourhood of piezoelectric oscillators operated at supersonic frequencies. The results of mathematical investigations on the effect of viscosity on the trans-

mission of acoustic radiation and an extension to the theory of the Rayleigh disc were also presented by Prof. L. V. King. The paper by Prof. A. F. Stevenson on the theory of current flow in heterogeneous earth was of interest to geophysicists.

In the Chemistry Sub-Section, Prof. C. F. Allen and his collaborators read a paper on the preparation and reactions of the simplest δ ketonic nitriles. Prof. W. Lash Miller read a number of papers on 'bios', and Prof. R. H. Clark, R. G. D. Moore and M. McArthur described the preparation of ten new derivatives of cinnamic acid and ortho-phenyl-phenol. The oxidation of methane at pressures between 100 and 200 atmospheres has been investigated by Prof. E. H. Boomer and J. W. Broughton, who find that methanol is the principal product. Dr. E. W. R. Steacie and E. Solomon read a paper on the decomposition of gaseous ethyl ether at pressures up to 350 atmospheres. Among the papers presented by Prof. Otto Maass, a series of experiments on the properties of liquids and vapours at the critical temperature were of especial interest. In collaboration with E. H. Morris, the new experimental technique which has been devised for measuring such properties as dielectric constant, refractive index and density was described, and it was shown that discontinuity exists between the liquid and vapour heated above the critical temperature.

In the Physics Sub-Section, investigations on the age of certain minerals, as determined from the radii of the rings in pleochroic haloes, were described by Prof. G. H. Henderson. The results are in fair agreement with the ages determined by the uranium-lead content. Prof. J. A. Gray spoke on the scattering of X-rays at small angles; experiments in collaboration with W. E. Bennett have indicated the presence of two distinct types of intense scattered radiation. One type is attributed to diffraction by small prisms, or spheres, and the other to a gas of high molecular weight. R. M. Stewart gave experimental formulæ for the law of decrement for the oscillatory motion of pendulums under atmospheric pressure. The results of a geophysical survey made with torsion balance and magnetic variometers in northern Ontario were presented by A. H. Miller. The presence of a dyke lying under 30 ft. or more of overburden, was indicated by both methods used. In a paper read by A. H. Snell, it was shown that about 350 lines in the molecular spectrum of hydrogen gave measurable Stark effect displacements in a field of 90,000 volts/cm. The successful use of photoelectric cells in the experimental determination of the velocity of projectiles was described in a paper by D. C. Rose. Prof. E. F. Burton and his collaborators presented a number of theoretical and experimental papers on hyperfine structure, nuclear moments, X-rays and atomic statistical fields, but space does not permit their discussion.

Meetings of Section IV (Geological Sciences) were attended by twenty members and some dozen non-members, including officers of the Geological Division of the Quebec Bureau of Mines. Announcement was made of the award of a Royal Society Carnegie fellowship to V. J. Okulitch, of the University of British Columbia and McGill University, who proposes to carry on research at Harvard University.

Twenty-six papers were read or presented by title at the several sessions. Among those which evoked the most interesting discussion may be mentioned papers by J. S. DeLury, on geothermal gradients and on the mechanics of igneous intrusion, and one by Prof. E. L. Bruce on the spectrographic examination of quartz from some gold-bearing quartz veins. Prof. G. H. Henderson gave a summary, illustrated by slides of photomicrographs, of two papers on pleochroic haloes in biotite, and a method of calculating from them the age of the mineral—papers he had presented before Section III of the Society. Prof. Henderson's talk was of considerable interest, and was followed by an informative discussion.

On May 23, twenty members and friends joined in a geological excursion to Levis and vicinity, conducted by Dr. B. T. Denis of the Quebec Bureau of Mines and Prof. T. H. Clark, and on the following day a number of members, at the invitation of Dr. John A. Dresser, visited the Notre Dame Mountains of Quebec, examining especially the rocks of the Serpentine Belt.

The presidential address delivered by Prof. Marie-Victorin before Section V (Biological Sciences) dealt with the flora and ecology of the different sections of the St. Lawrence River. Dr. Huntsman presented two interesting papers on the life and feeding habits of the Fundy salmon and herring respectively; apparently neither of these fish normally migrates so widely as has been supposed. A paper by R. E. Foerster reported reciprocal crosses of the five species of Pacific salmon. Several botanical papers contained results of more than usual significance. One by G. A. Ledingham announced that the zoospores of members of the Plasmodiophorales are biciliate, not uniciliate as hitherto described, and that one

cilium is much shorter than the other, indicating less affinity with the Myxomycetes than has been supposed and perhaps, as was suggested in the discussion, descent from algal Heterokontæ. Further evidence of polyphyletic origin of the Fungi was contained in a paper by H. S. Jackson which demonstrated close similarity in the life cycles and sexuality of Uredinales and Rhodophyceæ. Experimental plant embryology was the subject of a paper by Prof. R. B. Thomson, who described how the haustorium of *Marsilea* embryos develops spherically instead of in the typical cap shape when grown in culture fluid. Prof. G. W. Scarth gave evidence of a remarkable increase in cell permeability (to urea, etc.) in plants which have become hardened to frost. A useful and comprehensive summary of work done in the U.S. Department of Agriculture on cereal rust in relation to the physiology of the host was given by Dr. H. B. Humphrey.

The papers presented to the Medical Sciences Sub-Section covered an exceptionally wide range of topics. Sir Frederick Banting's group have continued their work on silicosis with the development of valuable new methods of attack on the problem, and have found important experimental evidence against the view that sericite, rather than silica, is the harmful substance. Outstanding among a number of communications from the Connaught Laboratories was an exhaustive quantitative study of the diphtheria-antitoxin content of human sera in various circumstances, by Dr. D. T. Fraser. Prof. J. B. Collip and his collaborators presented a series of papers on anterior pituitary hormones, among which Dr. Hector Mortimer's X-ray studies on experimentally produced changes in the rat's skull were noteworthy. Another group of papers was presented by Prof. C. H. Best, and included an account of different crystalline metallic salts of insulin by Dr. D. A. Scott. Prof. F. R. Miller reported on the effects of unipolar faradisation of the caudate nucleus; Dr. G. F. Marrian described improved methods for the isolation and chemical assay of œstrin; and Prof. C. C. Macklin strikingly demonstrated the existence of communicating pores, in the alveolar walls, between different lobules of the lung.

Obituary

DR. MARION I. NEWBIGIN

WE regret to record the death of Dr. Marion Isabel Newbigin, which occurred in Edinburgh on July 20. The removal of her outstanding personality marks a severe loss to geographical science in Great Britain, for she exerted a powerful influence upon the development of geography throughout the present century, by her own writings and teaching as well as by her admirable editing of the *Scottish Geographical Magazine* since 1902.

Dr. Newbigin, who was born at Alnwick in 1869, was one of a group of pioneer women who

received university training in natural science, and after studying at University College, Aberystwyth and at the University of Edinburgh she graduated as a B.Sc. of London in 1893. Devoting herself to zoology, she quickly established a reputation by her work on pigmentation in animals. She published papers on colour in two groups of birds (Trochilidæ and Nectariniidæ), others upon the pigments of decapod Crustacea and of the muscle of salmon. For this work and for her book "Colour in Nature, a Study in Biology" she received the degree of D.Sc.(Lond.) in 1898. Her interest in marine fauna is indicated by two papers

and by the volume "Life by the Sea Shore, an Introduction to Natural History" (1901). Although Dr. Newbigin then turned to the rapidly developing subject of geography, she maintained contact with biology in the Royal Physical Society of Edinburgh, of which she had been secretary and president, and as extra-mural lecturer on biology at the Womens' Medical School in Edinburgh until 1916. She published a work on animal geography (1913), and over a long period acted as assistant editor of the *Journal of the Royal Scottish Arboricultural Society*.

Dr. Newbigin brought her knowledge of environmental influences to bear upon the study of human activities with great effect; and her numerous geographical writings possess special value because of this. Her earlier books, which were of a general character, included "Tillers of the Ground" (1910); "Modern Geography" (1911); and "Man and his Conquest of Nature" (1912). She travelled widely, and methodically built her careful observations into a series of valuable regional interpretations. Of special note are her works on southern Europe:

"Geographical Aspects of Balkan Problems" (1915); "Mediterranean Lands" (1924); and "Southern Europe" (1932).

As a lecturer in geography, Dr. Newbigin was in great demand, and in recent years she gave regular courses at Bedford College, University of London. She rarely missed an International Geographical Congress, and she attended the meetings of the British Association regularly, presiding over Section E in 1922. She was the recipient of the Back Grant of the Royal Geographical Society in 1921 and the Livingstone Gold Medal of the Royal Scottish Geographical Society in 1923. The latter Society is especially in her debt for her loyal service and her unremitting labour in maintaining the high standard of its *Magazine* for thirty-two years.

WE regret to announce the death of Mr. H. Glauert, F.R.S., principal scientific officer at the Royal Aircraft Establishment, Farnborough, author of numerous papers on aerodynamics, on August 4, aged forty-one years.

News and Views

Prof. E. G. Coker's Retirement

PROF. E. G. COKER, who is this year retiring from the Kennedy chair of civil and mechanical engineering in University College, London, was appointed to his chair not long before the outbreak of the War, which found him in Australia, where he had gone as president of Section G of the British Association. In common with a number of other scientific workers, he had some unexpectedly exciting experiences on that occasion, narrowly escaping capture by the German cruiser *Emden*. Prof. Coker went to University College from the City and Guilds Technical College, Finsbury, where for some years he was the colleague of Silvanus Thompson, who was associated with some of his earlier work on polarised light. Before that time he was associate professor of civil engineering in McGill University, Montreal. Prof. Coker's name is chiefly associated, in the minds of engineers, with the direct exploration of stress in machines and structures by means of polarised light, a field which he has made peculiarly his own and which has been largely built up by his own efforts.

THE double-refraction caused by stress in transparent materials was discovered more than a century ago by Sir David Brewster, and the suggestion that this effect might be used to discover the stress-distribution in such materials was actually made by Brewster himself. Attempts in this direction were undertaken at various times, for example, by Clerk Maxwell, Carus Wilson, Mesnager and others, while the laws underlying the phenomenon have been investigated by a number of physicists. It was left to Coker, however, to develop the method, and to make it, by a variety of skilful contrivances (in particular his lateral extensometer), into a really

practical one. To him is due also the use of an easily workable material like celluloid for such investigations. By this means he has been able to solve a number of important problems relating to contact stresses, gears, test-pieces, architectural structures, etc., where mathematical analysis proved either inadequate or too complicated. For this work he created, at University College, a first-class research laboratory, which has attained a world-wide reputation. His recent treatise on "Photo-Elasticity", written in collaboration with his colleague, Prof. Filon, gives an exhaustive account of this subject, and embodies the results of a quarter of a century of continuous research. It is much to be hoped that this work will not be interrupted by Prof. Coker's retirement, and that he will continue, with unabated vigour and activity, to enrich engineering science in his chosen field.

New Vice-Chancellor: University of Melbourne

MR. R. E. Priestley, fellow of Clare College, Cambridge, and Secretary General of the Faculties of the University, has been appointed Vice-Chancellor of the University of Melbourne. Mr. Priestley was educated at Tewkesbury Grammar School and entered the University of Bristol in 1905. In 1907 he joined Shackleton's *Nimrod* Expedition as geologist. On returning from the Antarctic in 1909 he spent a year as a research student at the University of Sydney, working up the results of the expedition with Prof. Edgworth David. The sudden illness of Scott's geologist led to Priestley joining Scott's last expedition one week before the boat left Sydney. From 1910 until 1913 he was scientific observer with the northern party, first at Cape Adair, then at Terra Nova Bay. During the latter period

he spent a winter in a snow cave on half rations. On his return from the south in 1913, Priestley entered Christ's College, Cambridge, as a fellow commoner and research student with the view of working up the results of the expedition. On the outbreak of the War, Priestley was commissioned in the London Wireless Signal Section and served in France. At the end of the War he spent some fifteen months writing the official history of the signal service in the War. On returning to Cambridge he studied for the agricultural diploma and was appointed lecturer in soil science. In 1923 he was elected a fellow of Clare College.

SINCE then, Mr. Priestley has devoted himself almost entirely to administrative work. In 1923 he was appointed secretary of the Board of Research Studies, in 1926 secretary of the Board of Examinations, and in the same year secretary of the newly constituted General Board of Studies. In all these offices Mr. Priestley has been a conspicuous success. The introduction of the new University statutes altered the whole character of the General Board of Studies. The magnitude and importance of the work of the Board has steadily grown during the past eight years, and in the spring of this year a new statute was approved creating a new office of Secretary General of the Faculties, an office which was placed in Schedule B. Mr. Priestley was appointed first Secretary General of the Faculties and appointed to a professorial fellowship at Clare College. As secretary of the Board of Research Studies he has been of very great help to the large number of research students at Cambridge, more particularly to those from abroad. Many of them will welcome him on his arrival in Australia. His departure from Cambridge will be a great loss both to his College and to the University, but he will carry with him the best wishes of his many friends at Cambridge, who are confident that the University of Melbourne will gain very greatly by his appointment.

Food Research

In a paper on "the Research Movement and its Modern Developments", read at the spring meeting of the Manufacturing Confectioners' Alliance and the Food Manufacturers' Federation at Harrogate on May 13, Mr. A. L. Hetherington reviewed the way in which scientific research was being applied alike to industrial processes and to everyday life. Particular reference was made to the work being carried out under the Department of Scientific and Industrial Research through the various Research Associations, and more especially to the work of the Cocoa, Chocolate, Sugar Confectionery and Jam Manufacturers and of the Food Manufacturers' Research Association. The successful solution of the problem of bloom on chocolate was the result of a concentrated attack by a team of workers at the problem. Methods have been found of preventing mould growth and fermentation in jams, jellies, fondants, etc., without using prohibited preservatives, and the discovery of a method of slowing down the breakdown of the sugar in re-

heating sugar syrups has led to considerable savings in the use of high-grade sugars. Effective work has been done to combat infestation by the cocoa moth and other pests, and the Research Association's work has not only tended to raise the quality of the goods produced but also stimulated interest in the application of science and in the underlying principles of manufacture. In the view of the Advisory Council, no Research Association should be operating on a smaller scale than a minimum income of £10,000-£20,000 per annum, and Mr. Hetherington urged fuller support for the two food associations to raise their income to this minimum from the present inadequate £7,000 and £2,000 per annum.

Electric Shut-Down in London

THE sudden cessation of the supply of electricity over London and part of the south-east of England during midday on July 29 proves that even with the best machinery a breakdown in the supply is a possibility that has to be guarded against. Luckily it is an extremely rare occurrence. The trouble started apparently when the engineers were rearranging sections of the supply at the Battersea power station. A small section becoming overloaded, the automatic circuit breaker came into action. When the circuit breaker was closed the currents in two of the sections were probably not in synchronism and so a huge current circulated in the link connecting Battersea with the neighbouring station at Deptford West. The former had an output of 70,000 kilowatts at this moment and the latter of 90,000. The devices at Battersea declined to take the short circuit load, and several of the machines at Deptford shut down. The Barking Power Station had now to take the load, but the circuit breaker at Northfleet opened and the whole system ceased to operate. The effect was that the whole of the south-east area of the grid was suddenly deprived of 280,000 kilowatts of generating plant. The stations at Norwich and Brighton cleared themselves from the grid, the latter for about an hour. This affected the Southern Railway. The trouble was probably caused by the engineers taking advantage of the light load in summer to cut out certain transmission connexions for overhauling and so the grid system was not in full commission. It was not able to face the loss of Battersea, Barking and Deptford and still keep the whole system working. Notes on this shut-down are given in the *Electrical Times* of August 2.

Early British Camp

AN important discovery of, it is conjectured, either an early British camp or the site of the capital of one of the Kentish kings, is announced in the *Times* of August 6. The site is at Bigberry Woods, near Canterbury, and its exploration, which will occupy two seasons, has been undertaken by a committee, of which Lord Conway of Allington is chairman and Messrs. R. F. Jessup and N. C. Cook of the Maidstone Museum are the joint directors. A number of accidental finds have been made there in the past,

including a glass jug (Roman) and a large earthenware pot. Other finds have been made—chariot harness and gear, a slave charm and implements. It is thought that the position, occupying about 25 acres on the top of a hill, being a natural strong point, may have been held as a camp up to the time the Romans occupied the valley where Canterbury now stands. Cuttings have been made on the north side and have brought to light a ditch filled with rubble, broken earthenware and vegetable matter. The excavators have also found a rampart and a black occupational level which contains much broken pottery. More pottery was found in a cess-pit, but a cooking pit, flint-lined, serving a group of wattle and daub huts, contained little pottery. Excavations have also been begun on the south side, whence most of the previous material has come.

Control of the Bed-bug

THE Ministry of Health has recently issued two brochures dealing with the bed-bug, its habits and methods of eradication. While this insect is not known to be actually concerned with the transmission of the pathogenic organisms of any specific disease, its presence in large numbers is a menace to humanity. The insect is perhaps responsible for ill-health from lack of sleep due to skin irritation, and its presence accentuates the already insanitary conditions under which it thrives. During recent years, the problem of its eradication has come more and more into prominence in connexion with slum clearance and other schemes. A large number of tenants of 'council houses' come from verminous dwellings, and the need for ensuring that the new houses are not similarly infested from the outset is a matter of concern to the local authorities. A report of the Committee on the Eradication of Bed-bugs has recently been issued (Reports on Public Health and Medical Subjects. No. 72. 1934. 46 pp. H.M. Stationery Office, 1s. 0d. net). This Committee, under the chairmanship of Dr. G. W. Monier-Williams, has, in its report, summarised the present position and indicated the lines along which future work on bed-bug control might be profitably undertaken. The life-history of the insect is discussed, and various methods of control are dealt with. In view of the lack of accurate information as to the bionomics and habits of the insect, various lines are emphasised along which research requires to be carried out. The report is accompanied by two well-executed coloured plates, illustrating various phases in the life of the insect, together with an excellent annotated bibliography.

THE second brochure issued by the Ministry of Health on this subject (Memo. 180 Med.) is entitled "Memorandum on the Bed-bug and how to deal with it". It is intended for official use and has been prepared with the view of assisting sanitary officers and others in dealing with bed-bugs. It outlines the biology of the insect, gives instructions where to seek the insects, and cites the chief means of prevention and the best methods of extermination. For fuller information on the subject the report,

already mentioned, should be referred to. The memorandum is accompanied by the same coloured plates as are appended to the report. We welcome the appearance of these two publications since they supply, in non-technical language, accurate and up-to-date information on a long-standing problem. Its full solution is dependent upon research carried out along the lines indicated, and much remains to be done. Relatively little is known, for example, of the effects of climatic conditions on the breeding of the insect, or as to the extent to which it can survive on the blood of other animals in the absence of human beings. There is, also, much yet to be discovered with regard to the differential action of insecticides on the insect and its eggs. The effects of heavy infestation of bed-bugs on the general health of the people are still not properly understood, and there is real need for definitely ascertaining whether, under certain conditions, bed-bugs may prove to be the carriers of disease germs.

A New Skymeter

IN these days when many of our great cities are involved in so much rebuilding, the question of light easements of adjoining property frequently gives rise to the necessity for financial settlements or building restrictions involving a definite assessment of rights of light existing. Speaking generally, the law recognises that light enjoyed over a sufficient period, so far as the use to which the particular space lighted is usually put, cannot be materially encroached upon without some form of compensation. At one time, cases in the courts depended on such general evidence as could be brought forward; more recently, geometrical methods have been worked out whereby the actual illumination can be measured. These methods are laborious, and Mr. A. S. E. Ackermann, 17 Victoria Street, London, S.W.1, sends us particulars of an invention for determining sill ratios which involves neither photographic nor photometric work. It consists of a pane of clear glass attached to two adjustable radius bars, the whole mounted on a stand. This is set up to face the window in question with the centre of the glass at the middle of the sky area. The sine of the elevation is read and the sky area traced on the glass, the observer using a pinhole eyepiece. This diagram is transferred to tracing paper and the sky area measured by a planimeter. This area multiplied by the sine of the elevation angle and divided by a constant gives the sill ratio. The instrument is portable and weighs less than 9 lb.

Skating Rinks and Wave Bathing Pools

ICE skating rinks and wave bathing pools, being used mainly for pleasure, have until quite recently not been seriously studied from the engineering and scientific point of view. The Dolder ice skating rink at Zurich which was opened four years ago has proved such a success that Zurich is now the centre of the ice sports in Switzerland. In the *Escher-Wyss News* of May 1934, D. Mettler describes the open-air skating rink and wave bathing pool in Berne and

points out some of the considerations that lead to commercial success. A good natural water supply is essential as a supply from the town services can never be counted on. The ideal site should be in the vicinity of a wood and on the northern side of a hill as this makes the formation of ice less expensive. It is also advisable, as at Berne, to combine with the ice rink a bathing establishment for summer use. In Zurich the ice rink is combined with a swimming bath which serves in winter as the water tank for the ice rink. Concrete, iron, copper, cork and bitumen are used in the construction of the freezing plate. As their thermal coefficients of expansion are all different and the temperature fluctuations are large the problem presented difficulties. Owing to the thermal expansion, countless minute cracks appear on the plate and this luckily allows it to 'breathe' without injuring the network of tubes. The production of artificial waves in a bathing pool has been studied for many months in the hydraulic laboratory of Messrs. Escher Wyss. They now produce special plant called the 'undosa' for the economic production of artificial waves. Neuchâtel has an open air skating rink, and it appears that it is only lack of capital which prevents other Swiss towns from carrying out similar schemes.

The Science Museum

IN its annual reports to the Board of Education, the Advisory Council of the Science Museum, while giving a general review of the progress of the Museum as a whole, has usually devoted special consideration to one of the divisions, directing attention to the gaps in its collections and indicating how the collections should be developed. In its report for 1933, the Council has therefore dealt with the important sections Water and Air Transport, and its remarks go to show that unless steps are taken there is likely to be wasteful rivalry between the Science Museum and other museums supported by the State. Some of the aeronautical exhibits, the report says, are on loan from the Imperial War Museum and others from the Air Ministry. When the War Museum moves to its new quarters at Bethlem it may wish to withdraw its exhibits, while the Air Ministry is contemplating setting up a museum of its own. "This would inevitably create three exhibitions of aviation, each incomplete, and in competition with one another." The creation of the War Museum has already had an unfortunate effect on the Water Transport Collections, for as a result of its inauguration "practically no models of men-of-war of the period between 1914 and 1920 are available, and consequently the collection in the Science Museum is completely truncated. It is regrettable," the report says, "that in this, as in other cases, national collections of the same subject matter should be split up between different Museums, and thus lose much of their educative value to the public." Another rival of the Science Museum, not referred to in the report, may well be the National Maritime Museum, which must almost inevitably encroach on some of the territory already occupied by the Science Museum.

History of Self-Starters for Motor-Cars

THE Smithsonian Institution has received from the V. G. Apple Laboratories, Inc., of Dayton, Ohio, a valuable collection of early automotive electrical equipment. The founder of the firm, the late Vincent G. Apple, was one of the pioneers who improved motor-car ignition and lighting systems, and one of the first to produce a successful electric starter. This starter, which was very cumbersome, was listed in 1912 at 350 dollars. To-day, when practically every car has a self-starter, the advertising leaflets are amusing. "Every successful device for the public amusement passes through a period of such enormous popularity that the public overlooks its many imperfed details in the desire to be among the first to possess it." It is pointed out that the necessity of cranking the engine of a motor-car is a most exasperating drawback. Compressed air, gas, acetylene gas and spring starters have all been tried and, except when everything is favourable, they have been found untrustworthy. A starter is a convenience when a car is leaving the garage; it is a necessity when it stops at a busy street corner, but what about starting the car when it stops on a level crossing? The progress of perfecting these devices during the last few years has been so rapid that there is a danger of the beginning and intermediate steps being forgotten. The Smithsonian, therefore, is gathering a collection, as complete as possible, of lighting, starting and ignition equipment.

The American Institute of Electrical Engineers

IN commemoration of the fiftieth anniversary of its foundation, on May 13, 1884, the American Institute of Electrical Engineers has issued a very interesting memorial number of *Electrical Engineering*, representing the official monthly journal and transactions. This number, published in May, and containing more than two hundred pages, is dedicated "To the lasting memory of those public spirited leaders who founded and built to its present eminence the American Institute of Electrical Engineers, and to the inspiration of those of the present and future generations who will continue the constructive leadership of this agency for professional development". Among the famous names of contributors to this issue are those of A. E. Kennelly, who writes on "The Work of the Institute in Standardization", C. A. Adams on "Some Major Events in the Life of the Institute", E. W. Rice, Jr., on "A Century of Progress in 50 Years", M. I. Pupin on "The Equation of Electrical Propagation", while Elihu Thomson and D. C. Jackson deal respectively with "Some High Lights of Electrical History" and "The Evolution of Electrical Engineering".

THESE articles are most useful accounts of progress, and provide an illuminating perspective of the manner in which the electrical engineering industry has attained its present status through the continued effort of the comparatively few, of whom the foregoing names are representative. The biographical notices are no less than 92 in number; England

being well represented by the names of Heaviside, Kelvin, Preece and S. P. Thompson, all of whom were honorary members of the American Institute. The publication is a very fitting tribute to the pioneers whose work is so admirably appraised by C. F. Scott, a former president of the Institute, in the following words: "In the fabric of electrical engineering the long scientific threads of the warp are bound together and given pattern and utility by cross threads which are the life achievements of individuals. As the loom keeps weaving through the years new threads of scientific knowledge are added to the old, and new workers contributing woof of finer quality enrich the beauty and enhance the utility of the product."

Drought of 1934 in the United States

"By the close of May 1934 the most extensive drought in the climatological history of the United States had developed in the central valleys, the Lake Region and the North-western and Western States," states J. B. Kincer, Chief of the Climate and Crop Weather Division of the U.S. Weather Bureau, in the *Scientific Monthly* of July, p. 95. In North Dakota the three spring months (March-May) yielded only 1.25 in. of rain, against the previous low record of 2.15 in. in 1901. In the north-west the serious shortage in sub-soil moisture and surface water supplies is the result of an accumulated deficiency covering several years. There is no reason to suppose, however, that this prolonged deficiency indicates a permanent drift towards desert-like conditions; for long-period records show that periods of excessive drought may be expected to occur at intervals of 30-40 years. Thus similar periods of years with markedly deficient rainfall covered the ten years ending with 1864 and again the ten years ending with 1894, while between these periods were successive years with comparatively abundant rains. The 1934 drought was unusual in developing early, and as a consequence, instead of the corn crops being most seriously affected as occurs in summer droughts, the crops which have suffered most so far are hay, pastures and small grains.

Meteorology in Southern Rhodesia

ACCORDING to the meteorological report of the Department of Agriculture, Southern Rhodesia, for the year ended June 30, 1933, there was comparatively little change, up to October 1, 1933, in the number of observing stations representing that country, thirty-six new stations having been opened and twenty former stations altered or closed, the total number on that date standing at 601, of which all but fifty are rainfall stations. The seasonal rainfall was below the normal, as was that of the three preceding seasons with the exception of 1931-32, the deficit being nearly 4 inches. For the fourth year in succession, the seasonal rainfall was forecast with the aid of a formula based on the values of meteorological data at distant 'centres of action', and the sign of the departure from the average was successfully predicted again as at the three earlier attempts—a very praiseworthy result. The report

in its general lines follows those of the earlier years. Monthly means of barometric pressure, of temperature and of relative humidity for each of the twenty-four hours are given for Salisbury and Bulawayo, and monthly sunshine totals for the daylight hours; the distribution of rainfall for the whole period is shown cartographically in colours, and there are many climatic summaries on standard lines. There are also summaries of the upper winds measured with the aid of pilot balloons, and of the records of pressure tube anemometers situated at Salisbury and Bulawayo. Dines pressure-tube anemometers have been erected during the year at Fort Victoria, Que Que and Miami. Very satisfactory progress in the collection of comparable climatic data for this country is revealed by this well-arranged and clearly printed report.

The Periodic Law

THE Mendeléeff Centenary Lecture was delivered before the Chemical Society at the Royal Institution on April 19 by Lord Rutherford, and is printed in the *Journal* of the Society for May. Lord Rutherford gave an account of the researches on atomic structure which have led to a realisation of the true meaning of the Periodic Law (see NATURE, 133, 161, 656; 1934), with so many of which he has himself been associated. He dealt with the question of the order of the elements, as defined by the atomic number, with the discovery of isotopes, with the arrangement of electrons outside the atom, and with a number of related topics. The lecture sets out very clearly the course of investigation which has provided an explanation of the remarkable generalisation proposed by Mendeléeff in 1869, and also the elucidation of some points of difficulty associated with the Periodic Table before the work of Moseley in 1912-13, which Lord Rutherford described as "an outstanding landmark in the history of our knowledge of the elements".

The Zoological Park of Paris

MANY initial difficulties having been overcome, Paris has now a zoological park worthy of the nation, constructed in the Bois de Vincennes upon ground reserved by a law of 1860. The Parc zoologique du Bois de Vincennes, recently inaugurated by the President of the Republic, covers a triangle of about 14 hectares, the longest side bordering Lake Daumesnil. At one of the main entrances rises a hill 68 metres high, on top of which a group of picturesque rocks ingeniously masks two great reservoirs containing the water necessary for the animals. The general idea has been to avoid the stilted cramped zoological garden of the past and to exhibit the animals in open and appropriate spaces, as if in a state of semi-liberty. The photographs illustrating Jean de la Cerisaie's article in *La Nature* of July 1, p. 30, show that the idea has been carried out with skill and artistry. The Zoological Park of Vincennes with its 1,500 animal inmates takes its place worthily with the other modern zoos of Europe.

Hydrogenation of Coal in Australia

INTEREST is rapidly growing in Australia in the possibilities of producing liquid fuel by hydrogenation of coal. The compelling factors are the difficulties placed by foreign oil producing countries in the way of payment by Australia in primary products, considerations of defence and the problem of unemployment in the coal mining areas. The Prime Minister has recently appointed a committee representative of the States, the Department of Defence, Synthetic Coal Oil Products Pty. Ltd., and the Council for Scientific and Industrial Research to report upon the present situation. An immediate question is whether black or brown coal should be taken as raw material and, after that, the terms of reference to the Committee include suitable location for a plant using 1,000 tons of coal per day; costs of production; amount of protection or subsidy or both necessary to maintain operations; and resulting employment, direct and indirect. Presumably Australia will be well advised to await the results of the large-scale operations of Imperial Chemical Industries Ltd., under weigh at Billingham; but the indications are that success in Britain will be followed rapidly by developments on one of the coal fields of the Commonwealth.

Utilisation of Coal

IN the Watt Anniversary Lecture for 1934 of the Greenock Philosophical Society, Prof. W. A. Bone emphasised the continued importance of the coal trade as the mainstay of our national economy. As an unrepentant Free Trader, he pleaded for freer international exchange and held the revival of the coal export trade to be vital to our recovery and to brook no delay. Modern tendencies to economic nationalism, especially in agriculture, were brushed aside. Prof. Bone skilfully outlined modern technical problems. He is not unduly afraid of oil, and gives only a limited approval of hydrogenation for liquid fuel, justifiable probably on strategic grounds only. The use of pulverised coal—freed from ash—appeals to him as a problem to be studied with all the resources at command and he believes that it would be solved if a James Watt or Charles Parsons were to take it in hand. In conjunction with this it is interesting to read an address on "The Utilisation of Coal" given by W. R. Gordon, director of the Coal Utilisation Council, before the Royal Society of Arts (*J. Roy. Soc. Arts*, June 8, 1934). Mr. Gordon outlined the function of the Council set up by the organisation of producers and distributors of coal. The consumer is not represented. Even such large consumers as the public utilities appear to be regarded as competitors, for the Council appears to have a bias for the use of raw coal. In the subsequent discussion, the neglect of the consumers' requirements received adverse comment.

Modern Refrigerated Sea Transport

IN the July number of the monthly journal *Food*, under the above title is a description of the Commonwealth and Dominion liner *Port Chalmers*, the first vessel specially built with gas-tight refrigerated

compartments for the transport from New Zealand of chilled beef stored in an atmosphere containing carbon dioxide. The minimum temperature for beef is 29° F. if its qualities are to be preserved. At this temperature, bacterial growth is not entirely stopped and chemical oxidation of the fat continues to take place; consequently there is a time limit of storage in still air of about 35 days. In these circumstances, it has not been possible for beef to be exported from Australia and New Zealand to England. By storage in carbon dioxide, this time is considerably extended, and some experimental shipments having been successful, the *Port Chalmers* was designed with gas-tight welded compartments for the carriage of beef, and she has recently completed her maiden voyage. She is a motor-ship, 486½ ft. long and 11,610 tons dead weight capacity. She has six holds, five of which are insulated, and these can be maintained at various temperatures for chilled beef, frozen mutton, butter, eggs, fruit and other commodities. The refrigerating plant is of the usual type, but in addition there is a large battery of carbon dioxide cylinders from which the gas passes through a British Oxygen Co.'s heater to the chilled beef compartments.

Aluminium in Bridge-work

AN interesting development in bridge-work is described in the *Engineer* of July 27, in which is an account of the reconditioning of the Smithfield Street Bridge which crosses the Monongahela River at Pittsburgh. This bridge forms an important link in communication between Pittsburgh proper and the south side, and is used by trolley-cars, motor vehicles and pedestrians. Built partly of wrought iron and partly of steel and erected in 1882, it has at various times been widened and strengthened, but an examination made in 1926 showed that it was being subjected to excessive stresses. The main features of the bridge include two 'fish belly' trusses of 360-ft. span supporting a floor system which included timber decking 11 in. thick. At first it was considered a new bridge would have to be built, but financial reasons led to the matter being reconsidered, and it was finally decided to replace the whole of the girders, stringers and decking of the floor by aluminium, thus reducing the dead weight on the trusses. The heat-treated aluminium alloy used has an ultimate strength of about 26 tons, a yield point of about 16 tons and an elongation on 2 in. of 20 per cent, and the total saving in weight is more than 1 ton per lineal foot or 751½ tons in all. The cost of reconditioning has been 276,436 dollars, whereas the cost of a new bridge would have been about two million dollars. The bridge as it now stands is estimated to have a life of twenty-five years.

Mining and Fuel Research at Sheffield

THE report on research work carried out in the Departments of Mining and Fuel Technology of the University of Sheffield during 1932-33 (pp. 28. Sheffield: The University, 1933) reveals an extensive range of work bearing on the local industry of coal

getting and utilisation, such as the ventilating and lighting of mines. Of more general interest, a study of the fireproofing of timber showed that ammonium phosphate gave the best results. In fuel technology, the chemistry of coal and coke takes prominence, while combustion in internal combustion engines is under investigation. The prosecution of applied sciences in a university curriculum has received criticism in recent years, but there can be little doubt that the association of teaching with investigation of such technical problems will be of mutual benefit.

Bibliography of Seismology

WE have received the last quarterly part for the year 1933 of the valuable "Bibliography of Seismology" edited by Mr. E. A. Hodgson and issued by the Dominion Observatory, Ottawa. This part completes the tenth volume and contains the titles, and in some cases brief abstracts, of one hundred memoirs on seismology, published with few exceptions during the year 1933. The value of the work is much increased by the addition of two indexes, one of the subjects treated during the past year, the other of the authors, more than one thousand in number, whose works are catalogued in the tenth volume (1929-33).

First Tree Ring Conference

A CONFERENCE on tree ring studies was held on June 11-12, at the Museum of Northern Arizona at Flagstaff, under the chairmanship of Dr. A. E. Douglass of the University of Arizona. Among the problems discussed was the need for a journal in which to publish the original data on which climatological conclusions and prehistoric dates are based. It was, therefore, decided to publish a quarterly journal to be called the *Tree Ring Bulletin*, at a subscription price of 1.50 dollars a year. Dr. A. E. Douglass will be editor-in-chief; Dr. Waldo S. Glock, assistant editor; Dr. Harold S. Colton, managing editor; and Mr. John C. McGregor, assistant managing editor. While the publication will be of immediate interest to archaeologists, it will also deal with problems of climatology and other subjects to which tree ring studies are related. Further information can be obtained from Dr. Harold S. Colton, Museum of Northern Arizona, Flagstaff, Arizona.

Association of Special Libraries and Information Bureaux

THE eleventh annual Conference of the Association of Special Libraries and Information Bureaux will be held at Somerville College, Oxford, on September 21-24, under the presidency of Sir Richard Gregory. On September 21, Sir Richard will deliver his presidential address entitled "Science in the Public Press", when the chair will be taken by the past-president, Sir Charles Sherrington. The morning of September 22 will be devoted to a consideration of "Book Selection for Special and General Libraries", when contributions will be made by Mr. A. F. Ridley, "Book Selection for Special Libraries"; Mr. J. E. Walker, "Methods of Selecting Technical and Refer-

ence Books for General Libraries"; and Mr. S. G. Wright, "Book Recommendation Methods for University Libraries". Mr. H. V. Horton will also read a paper on "The Use of the Universal Decimal Classification in Photographic Abstracts". The afternoon will be devoted to a consideration of "Some New Libraries", when Mr. Charles Nowell will describe the "Manchester Central Library", and Mr. H. F. Alexander, the "Radcliffe Science Library, Oxford". In the evening, Mr. L. Urwick will read a paper entitled "The Idea of Planning". The morning of September 23 will be devoted to "Planning in its Relation to Information", when the following papers will be read: Mr. K. M. Lindsay, M.P., "Public Efforts at Planning in Great Britain"; and Mr. O. W. Roskill, "The Planning of Industry". In the evening, Mr. L. A. de L. Meredith will discuss "Publicity for Great Britain—Problem of the Supply of Information". In addition to members of the Association, the Conference is open to others who are interested. Further information can be obtained from the Secretary, 16, Russell Square, London, W.C.1.

Announcements

PROF. C. E. WEATHERBURN, professor of mathematics in the University of Western Australia, has been awarded the Hector Medal and Prize by the Royal Society of New Zealand, for his contributions to the subject of differential geometry.

MESSRS. ILFORD LTD. have recently published a booklet entitled "Photography as an Aid to Scientific Work". It is intended as a guide to the best type of photographic material for any given problem, and as such is to be recommended as a very useful book of reference. It is a common difficulty that workers in laboratories cannot obtain a concise and informative summary of the materials and apparatus now available. In this little book, Messrs. Ilford have succeeded in furnishing such a summary relating to the photographic materials which they manufacture.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:—A lecturer in electrical engineering at Swindon Technical College—The Education Officer, Clarence Street, Swindon (Aug. 18). A director of the University Farm, Cambridge—The Secretary, School of Agriculture, Cambridge (Aug. 29). An engineer and ship surveyor for the Mercantile Marine Branch of the Board of Trade—The Senior Staff Officer, Establishment Department (Mercantile Marine Branch), Board of Trade, Great George Street, London, S.W.1 (Sept. 12). A borough engineer and surveyor for Croydon—The Town Clerk, Town Hall, Croydon (Sept. 13). A botanist at the Royal Botanic Gardens, Kew—The Secretary, Ministry of Agriculture and Fisheries, 10, Whitehall Place, London, S.W.1 (Sept. 30). A chief chemist in the Public Health Laboratories, Cairo—The Royal Egyptian Legation, Bute House, 75, South Audley Street, London. An assistant information officer to the International Tin Research and Development Council—The Secretary, Manfield House, 378, Strand, London, W.C.2.

Letters to the Editor

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

Absorption Spectrum of Vitamin E

IN previous letters to NATURE^{1,2} Bowden and Moore described experiments on the absorption spectrum of the unsaponifiable fraction of wheat-germ oil, which were carried out with the view of deciding whether vitamin E possesses a characteristic absorption. It was found that the absorption in the region 3200–2850 Å. followed most closely the reputed biological activity. The intensity of absorption was much lower than that found in typical vitamin A concentrates, suggesting either that vitamin E absorbs much less strongly than vitamin A, or that it is present in wheat-germ oil concentrates in relatively small amounts.

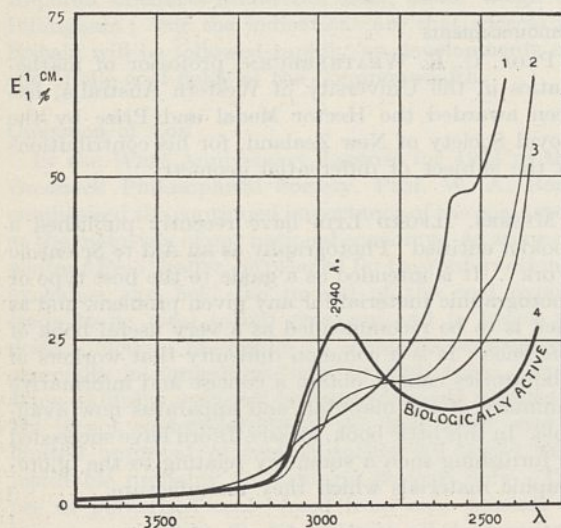


FIG. 1.

On the other hand, Olcott and Matill³ recently failed to find any characteristic absorption in a vitamin E concentrate prepared from lettuce, and considered it unlikely that the bands examined by Bowden and Moore were connected with biological activity. This was in harmony with the previous experience of Evans and Burr⁴ who had been unable to detect characteristic absorption in wheat-germ oil concentrate.

In a continuation of the work, we have prepared a wheat-germ oil concentrate by a simplified technique similar to that described by Evans and Burr⁵. After saponification, the sterol-free fraction of the non-saponifiable residue in which the vitamin is presumed to be present (that is, the fraction which is soluble in both methyl alcohol and light petroleum) was first submitted to chromatographic analysis by adsorption on alumina. The fraction least strongly adsorbed, which showed marked absorption in the region 3200–2850 Å., was then sent to Dr. F. H. Carr, of British Drug Houses, Ltd., who kindly undertook to distil the concentrate in the high vacuum apparatus

previously used in vitamin A distillations⁶. From 5.5 gm. of concentrate the following fractions were obtained: Fract. 1: b.p. 70°–93° C., 0.7 gm. Fract. 2: 93°–110°, 0.8 gm. Fract. 3: 110°–125°, 0.85 gm. Fract. 4: 125°–130°, 1.8 gm. Residue: b.p., above 130°, 0.35 gm.

The absorption curves in ethyl alcohol given by the above distillates are shown in Fig. 1. The most volatile distillate (fraction 1, curve 1) has a relatively low absorption in the region 3200–2850 Å. and a higher absorption in the further ultra-violet, with a subsidiary maximum at 2550 Å. The least volatile distillate (fraction 4, curve 4) shows an increased absorption in the suspected region (3200–2850 Å.) and develops a well-marked band here with a maximum at 2940 Å., $E_1^{1\% \text{ per cent cm.}} = 27$. The absorption at shorter wave-lengths has decreased. Fractions 2 and 3 appear to be intermediate stages between 1 and 4. At the temperature of liquid air, the band at 2940 Å. sharpens up still further, develops a slight structure, and shifts about 30 Å. towards longer wave-lengths.

Biological work is still in progress, but we have already been able to detect vitamin E activity in fraction 4, 16 mgm. of which caused a female rat, which had shown characteristic resorption gestation, to produce a litter of eight live young. We have therefore succeeded in detecting a sharp, if relatively weak, absorption band in a vitamin E concentrate of proved biological activity. Whether this band is to be ascribed to the vitamin itself, or merely to accompanying impurities, remains to be decided. It is encouraging, however, that Olcott⁷ has recently observed an absorption band in a concentrate prepared from cotton-seed oil in exactly the same position (2940 Å.) as that observed in the case of our wheat-germ oil concentrate.

A. J. P. MARTIN.
T. MOORE.
MARION SCHMIDT.

Dunn Nutritional Laboratory,
University of Cambridge.

F. P. BOWDEN.
Laboratory of Physical Chemistry,
University of Cambridge.

- ¹ Bowden and Moore, NATURE, 131, 512, April 8, 1933.
² Bowden and Moore, *ibid.*, 132, 204, August 5, 1933.
³ Olcott and Matill, J. Biol. Chem., 104, 423; 1934.
⁴ Evans and Burr, Memoirs of the University of California, 8, 144; 1927.
⁵ Evans and Burr, *ibid.*, 131.
⁶ Carr and Jewell, NATURE, 131, 92, Jan. 21, 1933.
⁷ Olcott, J. Biol. Chem., 105, proc. lxx; 1934.

Oscillations with Hollow Quartz Cylinders cut along the Optical Axis

A. HUND and R. B. WRIGHT¹ have tried to set into oscillation a quartz cylinder cut along the optical axis, and succeeded only in resorting to circuits which are so regenerative that they are on the verge of self-oscillation.

A careful study of the phenomenon of electrification of a quartz crystal by torsion² has led us to work with a co-axial cylindrical shell of quartz, the axis of the cylinder being cut along the optical axis of the crystal. With two electrodes applied to its inner and outer surfaces, such a hollow quartz cylinder constitutes a veritable cylindrical condenser, and can be easily set into oscillation in Pierce's circuit as an ordinary piezo-electric quartz plate.

A hollow quartz cylinder possesses, in general, three fundamental frequencies. Two of them, independent of the length of cylinder, are of ordinary piezo-electric character and correspond respectively to radial (along the wall thickness) and circular (along the wall circumference) vibrations of the hollow cylinder. These modes of vibration are clearly shown by marking out the actual piezo-electric axes by discharge points in glow pattern or under examination with polarised light. The third frequency is probably of torsional oscillation. Further details will be published shortly elsewhere.

NY TSI-ZÉ.
TSIEN LING-CHAO.

Institute of Physics,
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Peiping, China.
March 28.

¹ A. Hund and R. B. Wright, *J. Res., Bureau of Standards*, 4, 383; 1930. *Proc. Inst. Radio Eng.*, 18, 741; 1930.

² Ny Tsi-Zé et Tsién Ling-Chao, *C.R.*, 198, 1395; 1934.

Spontaneous Emission of Neutrons from Radioactive Isotopes

IN confirming the pioneer work of Fermi¹ on radioactivity induced by neutron bombardment, Curie, Joliot and Preiswerk² have shown that the radioactive isotopes produced when phosphorus and magnesium are bombarded by neutrons emit: (1) negative electrons, (2) high energy γ -radiation ($\sim 5 \times 10^6$ e.v.), (3) positrons (which they tentatively ascribe to pair formation, this explanation being very doubtful as the high energy limit of these electrons was $\sim 1.0 \times 10^6$ e.v.), (4) neutrons. The neutron emission they ascribe to $_{14}\text{Si}^{31}$ and $_{13}\text{Al}^{28}$, unstable isotopes produced by the initial neutron bombardment.

Goldhaber³ has shown, however, that these neutrons must get into a state of positive energy by some primary radioactive process and then be immediately emitted. It is the purpose of this note to support Goldhaber's suggestion and to indicate that the results observed arise from the β -ray radioactivity of the two isotopes mentioned.

It has been shown^{4,5}, from considering the nuclear disintegration experiments which have been performed, that the stable nuclei of the light elements of even atomic number consist of the maximum number of α -particles and neutrons, those of odd atomic number consisting of the maximum number of α -particles, a dipton and a loosely bound neutron. It has also been shown⁶ that isotopes of the light elements of even atomic number containing three neutrons and those of the elements of odd atomic number containing a dipton and two neutrons, are β -ray radioactive. In addition it has been demonstrated⁷ that β -radioactivity results from the formation of electron pairs within the nucleus with the production of a proton as the positron is captured by a neutron, the negative electron being emitted to form the disintegrating β -ray.

Applying these views, the β -radioactivity of $_{13}\text{Al}^{28}$ ($6\alpha + D + 2n$) results in the formation of a new α -particle in the nucleus by the union of the dipton and the new dipton formed when the positron of the pair unites with the neutrons. This α -particle is formed in a state of excess energy as shown by Oliphant, Harteck and Rutherford⁸. It may then transfer to the normal state and be bound within

the nucleus forming $_{14}\text{Si}^{28}$ (7α), with the emission of high energy γ -radiation. Or it may emit a neutron leaving $_{2}\text{He}^3$ within the new nucleus $_{14}\text{Si}^{27}$ ($6\alpha + D + p$) and this 'radiosilicon' containing a 'free' nuclear proton⁹ emits positive electrons transmuting to $_{13}\text{Al}^{27}$.

Similarly the β -ray emission of $_{14}\text{Si}^{31}$ results in the formation of a dipton within the nucleus, mass defect energy 5×10^6 e.v. being released. This may be emitted in the form of γ -radiation when the stable $_{15}\text{P}^{31}$ is formed, or the loosely bound neutron may be emitted immediately carrying the excess energy. As a result, 'radiophosphorus' $_{16}\text{P}^{30}$ is formed which spontaneously emits positrons transmuting to $_{14}\text{Si}^{30}$.

Thus, on the view of nuclear structure adopted, the γ -radiation of high energy, the neutron and the positron emission all result from the β -ray radioactivity of the unstable nuclei produced. It is to be noticed that spontaneous emission of protons is possible from $_{13}\text{Al}^{28}$.

H. J. WALKE.

Department of Physics,
Washington Singer Laboratories,
University College, Exeter.

¹ Fermi, *Ricerca Scientifica*, 1, 283, 330; 1934.

² Curie, Joliot and Preiswerk, *C.R.*, 198, 2089; 1934.

³ Goldhaber, *NATURE*, 134, 25, July 7, 1934.

⁴ Walke, *Phil. Mag.*, 17, 793; 1934.

⁵ Walke, *Phil. Mag.*, 18, 129; 1934.

⁶ Newman and Walke, *NATURE*, 134, 64, July 14, 1934.

⁷ Walke, *Phil. Mag.*, 17, 1176; 1934.

⁸ Oliphant, Harteck and Rutherford, *NATURE*, 133, 481, Mar. 31, 1934.

⁹ Walke, *Phil. Mag.*, 18, 154; 1934.

The Sycamore Maple in A.D. 1300

IN his description of the carvings of the sycamore on the shrine of St. Frideswyde in the Oxford Cathedral, Dr. Burt Davy¹ gives a list of ten species of plants that were in all probability growing in or near Oxford about A.D. 1300, when the shrine was being carved. It is only fair to note that the remarkable truth to Nature of the carvings of the fruits and leaves of this tree, and of the nine other species of plants mentioned by Dr. Davy, had already been recognised by Mr. S. A. Warner, with the addition of two more, the water crowfoot, *Ranunculus aquatilis*, and the hogweed, *Heracleum sphondylium*, to the list which, with three illustrations, is printed in my "Early Science in Oxford", vol. 3, p. 198.

R. T. GUNTHER.

The Old Ashmolean,
Oxford.
July 14.

¹ *NATURE*, 134, 61, July 14, 1934.

THE three illustrations referred to by Dr. Gunther do not include *Acer pseudoplatanus*, nor do his published notes make any reference to the fact that the carving is the earliest known record of the occurrence of the sycamore maple in Britain, antedating previous records by a quarter of a century. I did not mention the hogweed and water crowfoot, as their identification seemed less certain than that of the other species.

I owe Dr. Gunther an apology for not having mentioned the notes and reproductions referred to, which—I regret to say—I had not seen.

J. BURTT DAVY.

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Oxford.
July 21.

Reflecting Power of Aluminised Surfaces

DURING the course of some recent work on the reflecting powers of certain metallic substances in the ultra-violet part of the spectrum, I have had the opportunity of testing the behaviour of aluminium (deposited on to a glass surface by the new evaporation method) and it was thought that the results obtained would be of sufficient interest to justify this note. The accompanying table gives the values

λ	Proportion reflected	λ	Proportion reflected
3610 A.	0.84	2265 A.	0.86
3404	0.83	2196	0.86
3261	0.91	2144	0.84
2981	0.90	1990	0.87
2749	0.90	1936	0.87
2573	0.89	1863	0.70
2313	0.91		

for radiation of normal incidence, and the spectrograms (Fig. 1) show the relative 'density' of the lines (a) when employing the spark alone, and (b) when the reflecting surface was used. From these it will be noticed how regular is the reflection throughout the entire ultra-violet spectrum, and that the reflecting power is unusually high for a metal even down to $\lambda = 1863$ A.

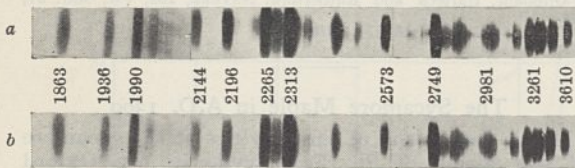


FIG. 1.

I wish to express my thanks for the co-operation of Mr. C. H. Walker of Messrs. Metropolitan-Vickers Electrical Co., Ltd., in producing the aluminised surface for the tests.

B. K. JOHNSON.

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June 29.

Asymptotic Developments of Periodic Functions related to Periodical Physical Phenomena

It is interesting to note that certain well-known results in electromagnetic radiation and wave mechanics may be deduced from general considerations regarding the nature of functions representing the solutions of differential equations of the field concerned.

Take, for example, the case of a field of electrons which may be regarded as singularities of the function representing the field. Suppose, as Ferrier has done, that $F(u)$ is a certain function (well determined) of relative velocities of any two electrons. If the movements are vibratory, $F(u)$ will be a periodic function with a maximum and a minimum. Such a function may be asymptotically developed. With given singularities, a differential equation may be easily found such that

$$W = H\nu$$

where W is the Einsteinian energy of the system and H is a function of Planck's constant h .

Again, developing asymptotically the solution ψ of Schrödinger's wave equation in the form

$$\psi \sim e^{iS} - \left(v_0 + \frac{v_1}{\lambda} + \dots \right),$$

Birkhoff¹ has shown that an invariantive relation for arbitrary linear transformations of the field is obtained. This result is obtainable from the linearity of the developments. Again, the wave equation

$$\nabla^2 u = c^{-2} \partial^2 u / \partial t^2$$

may be treated with the help of asymptotic developments of certain curls of the field. Recently, René Reulos² has obtained a general solution in a remarkably simple form by considering asymptotic developments. The solution replaces the ordinary method of retarded potential solutions although the solutions of Reulos approach in the limit the classical solutions in the case of electrons of constant velocity.

The peculiarity of all these solutions lies in the fact that no assumption need be made with regard to the structure of the electrons or protons or of the field concerned, except that there are certain singularities of fields representable by poles of functions regulating the general field.

In this connexion, a remark of Reulos's must not be overlooked. He finds that his solution of the wave equation differs from the classical solution in the case of accelerated electrons. The reason for this appears to me to lie in the fact that in an asymptotic development the convergence is sometimes restricted, and hence the result cannot be identical with that derived from a finite series.

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June 6.

¹ *Proc. Nat. Acad. Sci.*, March 1933.
² *C.R.*, 1015, March 12, 1934.

Shear Waves through the Earth's Core

IN 1914, Gutenberg¹ published an analysis of earthquake waves arriving at great distances, in which he inferred the existence of a major surface of discontinuity at a depth of about 1,800 miles, bounding a central core within the earth. His predictions regarding the characteristics of compressional (P) waves transmitted through this core have been abundantly verified. But until recently, no signs have been forthcoming of the existence of distortional (S) waves that had penetrated this central mass. The conclusion has thus gradually come to be accepted that the core is in a fluid or semi-fluid state, and is thus incapable of transmitting shear waves that reach its boundary. Two branches to both types of core waves were indicated by Gutenberg's theory, and have been designated by Macelwane P_1 and P'_2 , S'_1 and S'_2 respectively.

Recently Macelwane² and Imamura³ have published fragmentary evidence supporting the occurrence of shear waves transmitted through the core and conforming to Gutenberg's predictions. But the former expressed himself as dubious of the adequacy of the evidence; and the latter can scarcely be credited with settling the controversy on the evidence of a single identification—apart from the fact that the identification is open to criticism.

In studying the European records of the 1929 Buller (N.Z.) earthquake, I have found unmistakable signs of S'_1 at 16 stations between 145° and 175° from the epicentre. At Abisco (149.9°) and Pulkovo (150.6°), large amplitudes appear. Later, before 156° , signs of the second branch emerge, and reach prominence at Vienna (162.0°). This movement has been traced at 19 stations within 180° , and at 7 stations beyond. In most cases, the phase closely following, PPS , is also distinguishable and a separate curve has been plotted for it.

The travel-times for the shear waves agree with Gutenberg's predictions to within 10 seconds throughout most of the range; and point undoubtedly to the possibility of these waves having arrived at the antipodes by way of the core. Comparing these times for the two branches with the corresponding travel-times for the two branches of P' , we obtain ratios, for 165° , of 1.80 and 1.81, which agree remarkably well with the values for the velocity ratio (1.79-1.84) for P and S waves which have travelled wholly through the extra-nuclear layer. The rigidity of the core thus seems to be definitely established.

It seems appropriate at this juncture to revise the notation for these phases. Recently the Seismological Committee of the British Association has approved of the use of K instead of cP_c for compressional waves through the core; and 'SKS' has thus received official sanction. P' might similarly be written PKP . The objection to the dashed notation is that it has received wide support to indicate phases registered beyond 180° . The desirability of using it in this connexion for the shear waves beyond the antipodes emerges from what has been said above. In order to maintain a uniform notation, it is now suggested to employ Z for shear waves through the core; so that S'_1 becomes SZS ; and a square bracket or other similar device would indicate the later branch of each movement. Thus $P'_2 = [PKP]$, $S'_2 = [SZS]$ within 180° and $[SZS]'$ beyond.

L. BASTINGS.

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May 7.

¹ Über Erdbebenwellen VIII. *Nachr. Ges. Wiss. Gott.*, 125; 1914.
² *Gerlands Bei. Geophys.*, 28, 165; 1930.
³ *Proc. Imp. Acad. Tokyo*, 8, 354; 1932.

Structure of the Nitro Group

THE usual formula given to the nitro group is $-\overset{\text{O}}{\parallel}{\text{N}}$, containing a co-ordinate link¹, and it is supported by the parachor evidence². On account of this dissymmetry, both the compounds 1-4-dinitrobenzene and 1-3-5-trinitrobenzene should possess finite electric dipole moments. Also studies in benzene³ and in naphthalene⁴ have resulted in moments of 0.6 and 0.8 Debye units being ascribed to the di- and tri-substituted compounds respectively.

The electric moment μ is calculated from $\infty P_2 - EP_2 = 4\pi N\mu^2/9kT$ with the usual notation, the differences $\infty P_2 - EP_2$ having been found to be finite in the solvents used, and in the case of trinitrobenzene in benzene amounting to 14 c.c. The problem we have is correctly to assign these finite differences. There are three possibilities:

(1) The molecules have permanent electric moments.

(2) The differences $\infty P_2 - EP_2$ are real, but are to be ascribed to atom polarisation, this being the opinion of Smyth⁵.

(3) The last possibility, which it is hoped has now been proved, is that the differences are spurious, being due to specific solvent effects of benzene and naphthalene on the dissolved nitro bodies.

Now compounds of benzene and naphthalene with these nitro bodies are known^{4,6}, and if they exist in solution the usual dipole procedure will become upset, and the results will be of doubtful significance. That this has occurred has now been shown by measuring $\infty P_2 - EP_2$ for both 1-4-dinitrobenzene and 1-3-5-trinitrobenzene in the polar solvent chloroform, and in each case a zero value was obtained. The suitability of chloroform as a solvent for measuring the dipole moments of non-polar molecules was demonstrated by showing that $\infty P_2 - EP_2$ was zero for benzene in chloroform.

Evidently, then, both the nitro compounds are non-polar, the nitro group is symmetrical, and so, following the wave mechanical chemist, we say a

resonance exists between $-\overset{\text{O}}{\parallel}{\text{N}}$ and $-\overset{\text{O}}{\text{N}}\overset{\text{O}}{\parallel}$.

H. O. JENKINS.

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Oxford.
July 5.

¹ Sidgwick, "Electronic Theory of Valency", p. 65.
² Sugden, "The Parachor and Valency", p. 118.
³ Parts, *Z. Phys. Chem.*, 4 B, 227; 1929. Tiganik, *ibid.*, 13 B, 425; 1931. Lutzert, *ibid.*, 14 B, 31; 1931.
⁴ Briegleb and Kambeitz, *Naturwiss.*, 105; 1934.
⁵ "Dielectric Constant and Molecular Structure".
⁶ D. L. Hammick, Hills and Howard, *J. Chem. Soc.*, 1530; 1932.

Synthesis in the Œstrin Group

THE chemistry of α -folliculin (α -œstrone) is now fairly well understood, through the combined researches of the British and the German schools. It will no doubt be highly interesting to institute a series of synthetical investigations in this group of substances. Work in this direction has been in progress in this laboratory for some time past, and the opportunity is taken to place on record a brief outline of the method that is being pursued.

In the first instance, β -1-naphthylethyl bromide was condensed with the sodio-derivative of methyl β -keto adipate (b.p. $127-128.4$ mm.), which was prepared in quantity by the usual methods. The resulting ketoester smoothly underwent phenanthrene cyclisation in presence of sulphuric acid giving 2-carboxy-3:4-dihydrophenanthrene-1-propionic acid (m.p. $226-227^\circ$, once crystallised). The latter on distillation with acetic anhydride gave a beautifully crystalline substance (m.p. 210°) having the composition $C_{17}H_{14}O$. The œstrus-producing activity of the final product, which is being studied, is likely to yield interesting results. Further work along this line, starting from initial materials containing appropriate substituents, are actively in progress with the view of synthesising α -œstrone and other related ketones.

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July 9.

Micro-organisms and Plant Growth

THE correspondence (references in the letter by B. Viswa Nath and M. Suryanarayana¹) between one Finnish and two Indian groups of workers, on the effect of organic substances upon plant growth, is accentuating the need for collaboration between scientific workers. It is indeed curious to note how in this field of plant accessory substances, as in the field of work upon the effects of plants grown in association, workers have remained in ignorance of prior publications even within one country. I make no claim to priority, but, being fortunate in having access to the library of Rothamsted Experimental Station, I am familiar with the papers of most of the workers in both these fields.

A review entitled "The Derivation of the Nitrogen of Crop Plants, with Special Reference to Associated Growth" will appear in *Biological Reviews* in October. A section on "Accessory Factors and the Growth of Plants" does not pretend to be exhaustive, but contains references to work by the schools of Viswa Nath, Virtanen and others.

I think it important to point out that vitamins produced by plants, and required by animals, need not be identical with those accessory substances which may be required by plants for their own growth. This possible distinction does not appear to have been appreciated by Virtanen² and was tentatively rejected by Rowlands and Wilkinson³. It seems likely, as Indian workers have suggested, that the accessory substances required by plants are produced by micro-organisms with or without the aid of animals and animal secretions (Isaachsen⁴). A scheme has been put forward in my review, wherein the word 'phytamin' has been proposed for such true plant growth organic accessory substances.

HUGH NICOL.

Rothamsted Experimental Station,
Harpenden, Herts.
July 7.

¹ B. Viswa Nath and M. Suryanarayana, *NATURE*, **134**, 27, July 7, 1934.

² A. I. Virtanen, "Ueber die Stickstoffernahrung der Pflanzen". *Ann. Acad. Sci. Fenn.*, Ser. A, **36**, No. 12. Helsinki, 1933.

³ M. J. Rowlands and Barbara Wilkinson, *Biochem. J.*, **24**, 199; 1930.

⁴ H. I. Isaachsen, "Effekten av husdyrgjødsel kontra kunstgjødsel". *Tidsskr. norske Landbr.*, 225; 1933. Abstract in *Nordisk Jordbruksforsk.*, 67; 1934.

IN connexion with the correspondence in *NATURE*¹ on the effect of yeast extract on plant growth, writers upon this subject may be interested to know that yeast has for a long time been recognised as a fertiliser on the Keuper Marls around Burton-on-Trent. Thirty years ago it was a very common dressing on grassland, giving an effect resembling that of nitrogenous manure.

Credit for the discovery seems to belong to a certain farmer who carted 'barm' for his stock and then washed out his cart beside a pond in one of his pastures.

W. B. MERCER.

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Reaseheath,
Nantwich.
July 7.

¹ *NATURE*, **134**, 27, July 7, 1934.

Respiratory System of the White-Fly, *Dialeurodes dissimilis* Quaint. and Baker (Homoptera, Aleurodidae)

ACCOUNTS of the post-embryonic development of the tracheal system of any insect are extremely meagre. The development of the breathing folds (organs peculiar to the Aleurodidae and some of the Coccidae) has never been studied completely in any white-fly. I have carried out a study of the development of the respiratory system of the nymphal stages of the white-fly *Dialeurodes dissimilis* Quaint. and Baker, which occurs on *Ixora parviflora* in India, without doing any apparent damage to the host plant. Some extremely interesting and wholly unexpected results have thus come to light. The only previous account of the development of the tracheal system of a white-fly is that of Woodworth¹, which, however, is inaccurate in many respects.

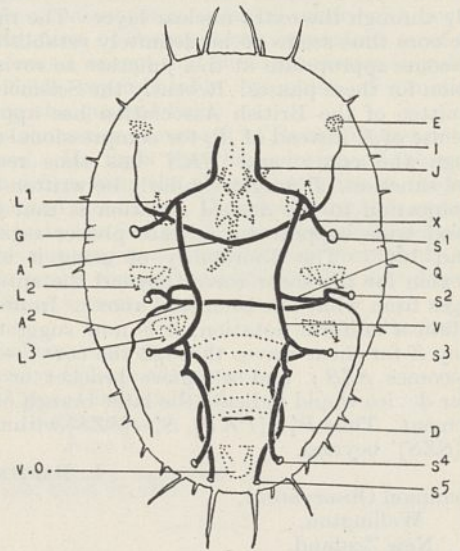


FIG. 1. First instar nymph showing tracheal system seen from the ventral side. Camera lucida drawing. $\times 185$.—A¹, anterior-dorsal commissural trachea; A², posterior-dorsal commissural trachea; D, dorsal-longitudinal tracheal trunk; E, eye; G, thoracic breathing fold; I, oculo-breathing fold trachea; J, oral trachea; L¹, L², L³, first, second and third legs; Q, palisade trachea; S¹, S², S³, S⁴, first, second, third and fourth spiracles; S⁵, probable fifth spiracle; V, ventral-longitudinal tracheal trunk; v.o., vasiform orifice; X, spiracular trachea.

The number of spiracles in *Dialeurodes dissimilis* in all the nymphal instars is four (probably five in the first instar); they lie on the ventral surface of the nymphs, but their exact position varies in the different instars. The third pair of spiracles is replaced by an entirely *new* one in the third instar. The spiracles, as studied in the pupa, are of a simple type, and have no closing mechanism.

The tracheal system consists fundamentally of paired dorsal- and ventral-longitudinal trunks, two dorsal commissural tracheae, the spiracular and palisade tracheae and the various branches of the main system, the most important ones being those belonging to the ventral-longitudinal tracheal trunks and are the following: oculo-breathing fold trachea dividing into an ocular branch and a breathing fold branch; oral trachea; mycetomal trachea; and several other smaller branches. Growth of the

tracheal system consists, on the whole, of arborescent branching of the system present in the first instar, but there also occur some remarkable changes of atrophy; for example, the dorsal-longitudinal tracheal trunk, which at first does not open directly into the ventral-longitudinal tracheal trunk, finally does so, and its end portions atrophy. The final number of the tracheal branches (in the pupa) is constant and is 156. There is a gradual shifting backwards of the tracheal system with reference to the body segments. Some of the tracheal branches in the pupa which are apparently homologous actually develop heterochronously.

The breathing folds are just visible in the first instar (except the posterior one which first makes its appearance in the third instar); their growth consists in the deepening of the furrows, the development of papillæ on the roof and the formation of elaborate marginal openings.

The detailed results of this investigation will appear elsewhere.

M. L. ROONWAL.

Department of Zoology,
University of Lucknow and
Zoological Laboratory, Cambridge.

¹ *Canadian Entomologist*, 33: 1901.

The Government and Inland Water Survey

I AM glad to see that the observations expressed in the leading article in NATURE of August 4 represent so clearly and unmistakably the views of the British Association Research Committee, of which I am chairman.

It may be added that on the occasion of the deputation to Sir Hilton Young, I directed his attention to the fact that our Committee comprises not only competent engineers and scientific experts of independent standing, but also technical representatives of the various Government departments interested (including the Ministry of Health), these gentlemen, although not officially nominated, being co-opted with the cognisance and approval of the departments concerned.

It is to be hoped, when the suggestions made by the deputation are receiving "the most careful consideration of the Government" promised by the Minister of Health, that the advice tendered by these technical officers will not be ignored, and that the Government will consequently be able to view the matter in its proper light and agree to action being taken along the lines indicated, without undue delay.

H. P. DOUGLAS.

Aug. 4.

Discovery of a Fossil Elephant in Palestine

QUITE recently a discovery of remains of an extinct elephant has been made in Palestine. This is the first time that such remains have been discovered there, nor have they yet occurred in Syria, and it will be of interest to see if this find has any connexion with the faunas of so-called African type which have been found in several Palestinian caves associated with a Mousterian culture and human remains.

The newly found specimens were obtained in digging a well in a garden at Bethlehem, but unfortunately the value of the remains was not at first recognised, and thus, except for a section of tusk 8 cm. in length, the bones and teeth are in a very

fragmentary condition. During a recent stay in Jerusalem, I was able, with the co-operation of the Museum authorities, to collect a few more fragments from the material dug out of the well. All the specimens have now been sent by the Department of Antiquities of Palestine to the British Museum (Natural History) for study. It is hoped that a detailed description of these remains will shortly be published, and that it may be possible for further excavations to be made at this locality. The deposit in which these elephant remains occur is doubtless Pleistocene, but information as to the precise age of the beds is still needed.

DOROTHEA M. A. BATE.

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British Museum (Natural History).

Aug. 3.

Luminous Night Clouds

ON the night of June 30–July 1 large masses of night clouds were seen over southern Norway, travelling with great velocity from east to west. Three of my aurora stations, Oslo, Kongsberg and Toemte, were in action, and a series of simultaneous photographs were taken from all three stations. By inspecting the plates, one gets the impression that the height was of the same order, about 80 km., as in 1932, but details can only be given when the plates are measured and calculated.

It would be interesting to know if the clouds have been seen in other countries. Probably they will appear again and a look-out for them is very desirable.

On account of their great height, they may perhaps disturb radio propagations, and observations in this respect would be very interesting.

CARL STÖRMER.

Dröbak, near Oslo.

July 10.

Hostility of Starlings to Swallows

HAS any special enmity of starlings against swallows been observed? If so, what is the reason suggested for it?

In my garden is a little lake, a shallow reach of which is largely used as a bath and for drinking by a great variety of birds, including starlings. A few swallows (*Hirundo rustica*) also skim the lake frequently for insects; and occasionally alight each day on one or other of the stones on the bank preliminary to drinking. Whenever a swallow thus alights whilst any starlings are near, one or more of the latter immediately rush viciously at the swallow, trying to peck it and driving it off. On the other hand, none of the many other frequenting birds, and not even the pugnacious blackbirds and sparrows, exhibit any hostility to these inoffensive, graceful visitors. Nor do the starlings, so quarrelsome amongst themselves, habitually drive off other birds than the swallows, but feed amongst many of them, although the latter are searching for the same food as themselves, worms, insects and beetles. Hence the motive of this hostility does not appear to be based on the food problem, or envy at the superior agility of the swallow in catching insect food on the wing.

L. A. WADDELL.

Ardslay, Craigmore,
Rothesay.

July 9.

Research Items

Head-Hunters of New Guinea. Dr. H. H. Sharp describes in *Man* of July the Gumakari people of the Suki Creek, New Guinea, in whose lives head-hunting plays an important part, and is in fact a religion. The Gumakari people inhabit villages in the lagoons and marshes drained by the creek to which the name Suki, a foreign name, has been applied. Dancing, head-hunting and hunting are their principal occupations. The chieftainship is hereditary, and exists in a virile form. The chief controls the cultural life of the people, and his power is remarkable. When the people go head-hunting they are accompanied by the women, who go to make sago and keep the party in food; but in a recent raid the women are said to have killed some Weredai who escaped into the water. The reason for a recent raid against the Weredai is said to have been that there were five widows in the village who could not have sexual intercourse or eat the flesh of kangaroos until heads had been taken. Since the raid the women have joined certain men of the tribe, but these were not men who were necessarily the 'big men' of the raid. The Gumakari are said normally to have taken their heads from a tribe of nomads, who live in a tract of bamboo-forest land on the banks of the Fly River. When a head is taken the victim is killed, if possible, by blows on the body; in some instances, the head is removed while the victim is alive. Old experienced hunters never break a head. The heads are carried back in a natural state, and after a ceremonial dance are preserved, the skin being retained over the skull. After two or three years, when they cease to be in good condition, they are buried without ceremony.

Studies on Diphtheria and Diphtheria Immunity. A remarkable epidemiological study, extending over ten years, of the occurrence of diphtheria and of diphtheria bacilli carriers, and of the development of immunity to diphtheria in a relatively isolated community with a population of approximately 1,000 susceptible individuals, is brought to a close by the issue of a report by Surg.-Capt. Dudley and May and Surg.-Com. O'Flynn ("Active Immunization against Diphtheria". *Spec. Rep. Series*, No. 195. Med. Research Council. H.M. Stationery Office. 3s. net). In 1921, permission was obtained to apply the Schick test of diphtheria susceptibility and immunity to the inmates of the Greenwich Hospital School; and since then up to the removal of the School from London last year, it has been possible to watch the distribution and development of diphtheria immunity and the occurrence of diphtheria bacilli carriers in this institution. In 1928, inoculation against diphtheria was introduced, allowing a comparison to be made between natural immunity acquired by a community in which diphtheria was endemic, and immunity artificially induced by inoculation. Prior to inoculation, the School was subject to an intense degree of diphtheria infection, for the average number of cases of diphtheria notified per annum was 45. In these circumstances, latent immunisation proceeds rapidly, so that it is calculated that three years' residence in the School produced an immunisation as effective as the usual prophylactic procedures, but with the danger that for every three or four latent immunisations, one case of diphtheria occurred. On the other hand, it was found that three doses of a diphtheria

toxoid prophylactic produced in 3 months as high a degree of immunity as the 3 years' residence, and with the added advantage of the almost complete disappearance of clinically recognisable diphtheria. No doubt the conditions at the Greenwich School were exceptional, and two plates, one of the boys at dinner, and the other of the sleeping quarters, illustrate the overcrowding that existed.

Bionomics of Two Estuarine Crabs. Under this title (*Proc. Zool. Soc. Lond.*, Part 4; 1933) Dr. Sunder Lal Hora describes the habits of the two Indian crabs, *Varuna literata*, Fabr., and *Sesarma tetragonum*, Fabr. The former is the commonest species of crab in the deltaic region of the Ganges. At Uttarbhat, 23 miles from Calcutta, it lives in the mud of the low-lying land in the neighbourhood of vast stretches of rice fields. During the wet season there is a good deal of brackish water, and in the dry season the earth becomes cracked into slabs which become detachable from the damp mud below, and the crabs live in these cracks. Later, when nearly all was dry, they made oblique burrows a couple of feet or so down and were found near the water-level. *Sesarma tetragonum* lives on the high banks of the water channels, digging a burrow almost vertically to the depth of the subsoil water. One was dug open and the water struck at about 5 ft., and there was about 8 in. of water in the burrow. The crabs were found above. The salinity of the water in the burrow was much less than in the adjoining channel. Neither of the crabs becomes completely dormant even at the height of the dry season when there is no food. Both have become almost terrestrial, although dependent on some moisture; they appear to want a certain amount of atmospheric air. They are thus not affected by changes of salinity so much as the truly aquatic species. The volume of the gills seems to be considerably reduced in *Sesarma*, and the gill chamber large, so that there are cavities for storing air. In *Varuna* the gill chambers are filled by the gills and no accessory devices were noticed. The author thinks it probable that the gills themselves have become specially modified for aerial respiration.

Classification of Nematodes. I. N. Filipjev (*Smiths. Misc. Coll.*, 89; 1934) considers that, in various morphological features and in their physiology, free-living nematodes, and especially the marine forms, are primitive. He agrees with Bastian that the organisation of the free-living forms "as a whole differs in no obvious or important manner from that of their parasitic kindred", and hence the group cannot be divided into two—one for free-living and the other for parasitic members. The author proposes a classification into eleven orders, and provides a key thereto and keys to the families included in six of these orders. He points out that the emphasis on parasitic forms is merely a result of the historical sequence in the study of nematodes, for systematic studies of parasitic nematodes have been carried out by numerous workers since they were initiated by Rudolphi in 1819, whereas the study of free-living nematodes began with Bastian in 1865, and only during the last fifteen years has there been a notable increase in the workers on them. A table shows that the number of species described to the end of

1930 includes 2,165 free-living and 2,436 parasitic—the latter figure being regarded as subject to correction. Among collections of marine free-living nematodes a large proportion prove to be new species, and the author gives his opinion that the marine species probably exceed in number both parasitic and fresh-water species together. Eight plates with seventy figures serve to illustrate the principal characters of five of the orders.

Diptera of Patagonia and South Chile. Two new fascicles of a work on the Diptera of Patagonia and South Chile, in course of publication by the British Museum (Natural History), have appeared. They deal with a number of families of the Acalyprata together with the families Syrphidae and Conopidae. Various new genera and a number of new species are here described for the first time. The descriptions, it may be added, are accompanied by admirably clear text-figures and plates. The Acalyprata are dealt with by Mr. J. R. Malloch, who is also jointly responsible with Miss D. Aubertin for the Conopidae, while the Syrphidae are described by Mr. R. C. Shannon and Miss D. Aubertin.

The Periodic Table in Plant Physiology. The late Prof. R. W. Thatcher has proposed a scheme (*Science*, May 25, 1934) for the classification of the chemical elements on the basis of their functions in plant nutrition, attempting to correlate these with the positions of the elements in the periodic table. The scheme rests on the observation that elements which are closely associated in the periodic table may be grouped together on the basis of physiological function in the plant. The chief value of the proposed scheme is that it will serve to remind plant physiologists of the existence of the periodic classification of the elements, and thus render their nutrition data more intelligible, but carried to its logical conclusion it will surely result merely in a restatement of the periodic law, that the properties of the elements (*including their biological properties*) are a periodic function of the atomic weights. It follows therefore that elements which in virtue of their similar fundamental properties are situated in adjacent places in the periodic table must necessarily serve closely similar functions in the plant. The observation that in certain cases potassium is absorbed readily by plant cells, whilst the closely related element, sodium, is excluded, provides an apparent exception, but in the ultimate analysis this difference in behaviour must be due to some difference in the specific properties of the elements relative to the living cell. That the elements concerned in nutrition are confined to the first half of the periodic table may be explained on general permeability grounds, the heavier elements being excluded. Information regarding the precise functions of the elements in nutrition is at most fragmentary except in the case of elements like carbon, nitrogen, oxygen, sulphur and phosphorus which enter into the actual structure of the cell, and do so presumably because of their peculiar valence properties and capacity for entering into large molecular complexes. In this connexion, it is significant that carbon, nitrogen and oxygen, the chief components of protein complexes, have closely similar atomic diameters.

Chromosomes of Cotton Hybrids. A cytological study of certain hybrids between Asiatic and New World cottons has been made by Dr. A. Skovsted (*J. Genet.*,

28, No. 3). The former have $2n = 26$ chromosomes, while most species of New World cottons have $2n = 52$. One of his hybrids had 39 chromosomes and the other 52. It is inferred that a diploid egg of Asiatic cotton functioned to produce the latter. From measurements of the chromosomes, Skovsted concludes that those of the Asiatic species are of equal size and large, while the New World cottons have chromosomes half of which are large and half smaller. In hybrids with 39 chromosomes, previous workers have found 13 bivalents and 13 univalents at meiosis. He finds many irregularities, and that groupings of 3, 4, 5 and 6 chromosomes are frequently present. The nuclei may also fuse, producing gametes with the unreduced number of chromosomes. At least 13 univalents were present in both hybrids. The conclusion is drawn that the chromosomes of Asiatic cotton are homologous with half those of the New World cottons, the other half forming the univalents. The New World cottons are therefore regarded as amphidiploid species, formed by chromosome doubling in a hybrid between an Asiatic species with 13 large (haploid) chromosomes and some unknown species having 13 small chromosomes. If this difference in the size of the chromosomes is confirmed, it should be of considerable value in helping to trace the chequered history of the cultivated cottons.

Continental Undulations of the Geoid. This is the title of a memoir (in English) by R. A. Hirvonen in No. 19, *Veröff. Finnischen Geodätischen Institutes, Helsinki*, 1934. It opens with an account of the theory connecting the form of the geoid with the variation of gravity, the work of Stokes, Helmert, Pizzetti and Hopfner being specially considered. The available gravity data are then applied to determine the order of magnitude of the warping of the geoid, and it is found that this does not generally exceed 100 metres and is on an average ± 50 m., contrary to the conclusion of Hopfner and Ackerl, whose estimate was $\pm 1,000$ m. The ellipticity of the equator is considered well-established, the longer axis being somewhat westward of the Greenwich meridian.

The Beilby Layer. G. I. Finch, A. G. Quarrell and J. S. Roebuck (*Proc. Roy. Soc., A*, July) have obtained very interesting results which seem conclusively to demonstrate the existence of a flowed amorphous surface layer on polished metals. In their experiments, a metal layer was evaporated on to a metal surface, while the latter was being examined in an electron diffraction camera with fluorescent screen. When zinc was deposited on an etched copper surface, the normal zinc diffraction rings appeared and remained unchanged for a long time. On a polished surface, however, the zinc rings flashed up and then disappeared in the course of a few seconds. Photographs show that the rings disappear without appreciable broadening. These experiments add very strongly to the evidence for the Beilby layer of flowed amorphous metal on polished surfaces. It has been known for some time that a polished surface gives rise to a random scattering of electrons, but some uncertainty still existed about the interpretation of this result. In the present work, the zinc layer on polished copper was not readily removed by rubbing and the zinc crystals appear to dissolve in the surface layer. Similar results were obtained with several other pairs of metals.

International Congress of Anthropological and Ethnological Sciences

THE first session of the recently constituted International Congress of Anthropological and Ethnological Sciences was held under the patronage of H.R.H. the Duke of York and the presidency of the Earl of Onslow at University College, London, on July 30–August 4. Owing to the regretted absence of the Duke of York through illness, the Congress was declared open on July 30 by H.R.H. Prince George.

The members of the Congress numbered more than eleven hundred, of whom about a thousand were present, including delegates from forty-two foreign countries and British dependencies, and representatives of a large number of universities, academies and other learned bodies.

The work of the Congress was distributed among eleven sections and more than four hundred communications were presented. The sectional presidents were: *Aa* (Anatomy and Physical Anthropology) Sir Grafton Elliot Smith (London); *Ab* (Anthropometry) Prof. H. J. Fleure (Manchester); *B* (Psychology) Prof. F. C. Bartlett (Cambridge); *C* (Demography) Prof. C. B. Fawcett (London); *Da* (Ethnography, general) Dr. A. C. Haddon (Cambridge); *Db* (Ethnography of Africa) Rev. E. W. Smith (London); *Dc* (Ethnography of America) T. A. Joyce (London); *E* (Technology) H. Balfour (Oxford); *F* (Sociology) Prof. C. G. Seligman (London); *G* (Religions) Prof. E. O. James (Leeds); *H* (Linguistics and Writing) Dr. Alan H. Gardiner (London).

In addition to the communications presented in the sections, addresses to the Congress as a whole were delivered by Prof. T. C. Hodson on "Certain Aspects of the Indian Census, 1931", on August 1; Dr. R. R. Marett on "Movements and Tendencies in the Anthropological and Ethnological Sciences", on August 2; and by Prof. J. B. S. Haldane on "Anthropology and Human Biology", on August 3. In addition, the Royal Anthropological Institute met with the Congress for the delivery of the Huxley Memorial Lecture by Sir Aurel Stein on "The Prehistory of the Indo-Iranian Borderlands as illustrated by Recent Exploration", on July 31.

Any attempt to give even a list of the communications within a reasonable limit of space is an impossibility, nor can attention be directed to all the papers which dealt with topics of outstanding interest. The selection of questions to which discussion was directed in the preliminary outline of the programme issued with invitations to the Congress had been drawn up with much care to cover all the more important topics of discussion among anthropologists at the present moment, including matters of practical significance, such as the position of witchcraft in Africa under present administrative regulation. Attention will be confined here to a few of the questions discussed, without any implication as to their importance or interest in relation to others which must be passed over owing to limitations of space.

The opening remarks of the president of the Section of Anatomy, Sir Grafton Elliot Smith, when directing attention to the bearing of the study of race and culture on the claims now being put forward on behalf of the Aryans in the political life of Germany, and pointing out that the only contribution the Aryans could have made to the culture of early Mesopotamia was to borrow from it, struck a note

which was characteristic throughout the proceedings of all the sections. This was the realisation that the study of man deals with a living subject of vital import to man. It was apparent not merely in questions of direct practical applications, such as the problems of dysharmonic cultural contact and administration in tropical and sub-tropical dependencies, but also in other matters, such as descent and race, more often treated as though they were solely of scientific interest.

Two discussions in the Section of Anatomy were especially interesting in view of current controversy and discussion of method, one on "Man's Relation to the Primates", the other on the "Anthropological Aspect of Blood Grouping". The former was opened by Prof. W. E. Le Gros Clarke (Oxford), who argued that the human stem might already have become segregated at a much earlier stage in evolution than was generally supposed. It had been held that this took place in miocene times in a *Dryopithecus* group, which also provided the direct ancestors of the modern ape; but recent discovery had established that the modern apes were fully differentiated by the beginning of the miocene. Prof. W. K. Gregory (New York) carried further his deductions from detailed comparison of the extremities of man and the apes, and Dr. L. S. B. Leakey (Cambridge) demonstrated the features, more particularly the characters of the teeth, upon which he had based his classification of *Homo kanamensis*, directly ancestral to modern man. The results of an examination of the palaeontological evidence associated directly with early types of man with the view of determining the relative date of these types, by Mr. A. T. Hopwood (London), not only pointed to *Eoanthropus* as the earliest form, but also, in showing a closer affiliation of the human form with the western group of fossil anthropoids, lent support to the view that the place of origin of man might be expected to be nearer the west than the east. The president, in closing this session, said that the discussion, like others on this subject, had tended to consider man's place in time rather than his relation to the primates. While pointing to the high antiquity now attributed to modern man on the evidence of Dr. Leakey's discoveries in East Africa, as well as of the Lloyd's skull, he expressed some doubt as to the wisdom of basing a separate classification of *Homo kanamensis* on a pathological specimen.

In the discussion on blood-grouping, Prof. V. Suk (Brno) gave a comprehensive summary of work on this method of investigation of racial questions and more especially of recent developments. He stressed, though not unduly, the difficulty, as yet, of arriving at any clear-cut conclusion, and held that the new facts, in so far as they can be called fully established facts, cannot yet be completely correlated with other traits to represent a criterion in racial classification. Dr. H. J. T. Bylmer (Bloemendaal, Netherlands), on the other hand, in the light of his experience in the Dutch East Indies, endeavoured to find a resolution of such difficulties; while Prof. Ruggles Gates (London) offered a genetical interpretation of the blood group with special reference to the problem of the American Indian. This pointed to isolated tribes from East Asiatic islands as the ancestors of the Amerindian post-glacial migrants. He referred also to the evidence from other peoples of peripheral distribution, and concluded that the blood-groups did

furnish important evidence of racial relationships, migrations and mixtures. They were also useful in confirming conclusions regarding crossing reached on the grounds of physiognomy. In Section *Ab* (Anthropometry) a great part of the time available was devoted to the discussion of the system of measurement in anthropometry and its technique. Important progress was made. Further attention will be given to this subject later.

In Section *B* (Psychology), a communication by Dr. C. S. Myers (London) was of special interest in its bearing on the current topic of mental characters and race. He pointed out that while primitive man of to-day, it had been found, was not radically different from his more advanced brother, most of such differences as were observed were material for the social psychologist, for they were mainly due to the social factors of environment and tradition; nevertheless, the possible inheritance of 'collective

unconscious' factors could not be wholly ruled out.

In the same section, Prof. Arnold J. Toynbee (London), on "Psychological Problems which arise from the Contact of Cultures", said that the historians of the future would say that the great event of the twentieth century was the impact of Western civilisation upon all other living societies of the world of that day. The principle of national self-government had arisen in a West-European social environment, which was exceptional; but the Near Eastern peoples had been led by West-European dominance to 'scrap' their own institutions, and havoc had ensued.

In the final session of the Congress, a number of important resolutions were passed and research committees appointed. It was decided that the next meeting of the Congress should take place in 1938 in Copenhagen, the president to be Prof. T. Thomsen of Copenhagen.

Lightning and High-Voltage Power Transmission Lines

IN a paper read to the South African Institute of Electrical Engineers in November last by E. F. Rendell and H. D. Gaff, an analysis is given of the faults due to lightning on the overhead lines connecting two stations—the Witbank and the Brakpan—belonging to the Victoria Falls and Transvaal Power Co. of South Africa. There are two parallel three-phase circuits connecting the two stations and the maximum load is 350 kilowatts. The voltage between phases is the same as that of the British Grid, namely, 132 kv. The three lines forming each set are of steel-cored aluminium and are in a vertical plane, the distance between the two planes being 23 feet. There is no transposition of the conductors (sometimes done to avoid interference with neighbouring telephones) and so they are parallel to one another. The distance between the top conductor of a set and the middle conductor is 12 ft., being the same as the distance between the middle and the lower conductor. An earthed guard wire was originally placed above the two sets at a distance of 18 ft. from the top wire of each set. The height of the lowest conductors from the earth averages 56 ft. The function of the guard wire is to 'protect' the circuits from lightning. There are 303 suspension towers for the circuits between the two stations.

Two cinematograph cameras were installed at Witbank, and one at Brakpan, three years ago. Any full voltage fault automatically starts the cameras recording. In this way, very complete film records have been obtained of the currents, voltages, etc., during every fault for the last three years. It is generally agreed that there are four possible ways in which a lightning fault may be caused on a power line. It may be due to the induced voltage in the conductors causing a rise of pressure which flashes over the string of insulators to the earth. Or it may be due to the lightning flash striking a suspension tower directly. It might strike a conductor directly. There is a possibility also that a streamer from a lightning flash to the earth might strike a conductor. The records provide some evidence that the first two causes are quite possible, but they only give negative results with regard to the last two.

It is well known that lightning faults are rarely evenly distributed along the length of a transmission line. In general, some sections of the line

are immune from faults whilst in other sections, severe and continually recurring faults may be experienced. The reasons usually given are varying radioactivity on the geological strata causing more frequent flashes in certain locations. Variations in the electrical resistivity of the geological strata, which have the effect of altering the resistance to the earth of the various towers, may have an effect on the frequency of the occurrence of the faults. The records show that no faults occurred between towers 264–297, a distance of about six miles, and there were 65 between towers 120–164, a distance of roughly eight miles. Owing to faults recurring in a particular section, additional guard wires were erected over it. This, however, seems to have had the effect of increasing the number of faults.

The authors have found that there are appreciable differences in what happens when a fault on a single line occurs and when there is a simultaneous fault on two lines. The differences occurred so consistently that they indicate a fundamental difference in the active cause in the two cases. When a fault occurs on one of the circuits only, it is rare for more than one phase to be affected. With double-line faults, the majority occur on only one phase, but there are an appreciable number affecting two phases. Invariably the same phase or phases of both lines are affected. With single-line faults, the top conductor is the one most frequently affected; with double-line faults all phases are approximately equally affected. The equal distribution of faults between all phases in the case of double-line faults suggests that such a fault is due to a direct stroke on the tower causing an over-voltage, and consequently the highest conductors at the instant of the stroke are the ones affected.

The value of the resistance to earth of a tower seems to have little effect on the number of single-line faults that occur. With double-line faults, on the other hand, increasing the insulation diminishes their number without increasing the number of faults on neighbouring towers. The records show quite definitely that with single-line faults the conductor furthest removed from the earth is the one most frequently struck, whilst with double-line faults the conductors are all equally liable to be struck. They also show that with single-line faults additional

guard wires decrease the number of faults and protect the top conductor but apparently make the bottom conductor more liable to be struck. On the other hand, simultaneous double-line faults seem to occur more frequently when guard wires are used.

In spite of the severity of the storms that occur in the Rand, the operation of a single line of towers carrying two power lines has been successful. Since they started operation in April 1926 they have never been rendered unserviceable by a lightning fault. Most engineers would prefer to have two separate rows of towers several hundred metres apart each carrying three wires which form the edges of an equilateral prism. Some of the phenomena that would occur in this case would doubtless be similar to those observed by the authors.

Atmospheric Pollution

THERE is an impression that American cities are smoke free. This is only true to a limited extent, and in some respects Americans are very tolerant. The smoke of an American railway engine must be seen to be believed, and Dr. Meller's broadcast talk on December 28, 1933 ("The Smoke Abatement Outlook". By H. B. Meller. The Mellon Institute, Pittsburgh), tells a tale of the evil and damage done by smoke, which reads very familiar. He makes the point that following water, sanitation and food comes naturally the need to improve the quality of our air supply. "Remember," he says, "the demand we are now hearing for a new deal in air is coming from those who are living in houses of the type to which we long have been accustomed. How much stronger will be the cry for effective abatement of smoke when we begin to promote construction of the new style dwelling-house which science has developed. Samples of such houses were enthusiastically viewed for the first time by the masses at the Century of Progress Exposition. Small houses they are, with flat roof surfaces devoted to play spaces and sun parlours; all of them equipped for air conditioning; every one constructed so that each room can be flooded with sunlight. In short, dwellings designed to make much fuller use of free and inexhaustible health-giving natural resources—pure air and unfiltered sunlight. Smoke challenges the use and enjoyment of houses of the new type. Excessive air pollution largely defeats the purposes of a roof playground and sun parlor. The sooner we realise these facts, the quicker we will take steps to bring smoke under adequate control."

Dr. Meller goes on to plead for withdrawing exemption from smoke abatement ordinances from domestic fires and due attention to atmospheric pollution in schemes of rehousing. Both pleas are also relevant in Great Britain. The traditional pitched roof was inevitable so long as available weatherproof materials could only be got in small pieces, but quite unnecessary now that modern methods and materials of construction enable the flat roof to be easily made. Flat roofs would greatly increase the effective area of cities, as a glance at maps will show, and that without extending the boundaries. Moreover, this roof area, the most remote from traffic and noise, will be increasingly prized as smoke is diminished. The realisation of all this may be expected to increase the call for cleaner atmosphere by many who are now indifferent—householders, property owners and civic authorities. Unfortunately it is just here

where individual action is so ineffective, and full benefit can only be realised by the construction of whole estates without smoky appliances. What an opportunity is presented by our new housing schemes if only it could be grasped!

The report of the investigation on air pollution described by the Department of Scientific and Industrial Research (H.M. Stationery Office. 5s. net) shows that systematic recording is increasing and that improvement of atmospheric conditions continues. Pollution by motor exhausts has been examined this year, but systematic recording is not deemed necessary. The deposit of tar, compared with the average of the previous five years, was lower by 14 per cent and of total solids by 11 per cent. Deposition of sulphates has also diminished. The highest figure was recorded at Ravenscourt Park, London, and the lowest at Templenewsam Park in East Leeds. Westminster is one of the worst spots in the country for smoke haze, from which again Coventry is practically free. Coventry is a model city in this respect, whereas London compares unfavourably with many industrial towns.

The limited measurements available indicate that the loss of sunlight due to air pollution averages 20 per cent over the year and more than this in winter. Last year the reasons for the fine records for Coventry were given as being partly geographical and partly the extensive use of smokeless methods in domestic and industrial practice. The lesson of these records cannot be too widely published at the present time.

H. J. H.

University and Educational Intelligence

CAMBRIDGE.—The General Board has given notice that Dr. C. G. Lamb will resign the readership in electrical engineering on September 30, but it is not intended to recommend the continuation of the readership.

R. D. Davies, of Gonville and Caius College, has been appointed University demonstrator in engineering.

At King's College, A. M. Turing has been elected to a Harold Fry studentship, K. C. Dixon to an additional Harold Fry studentship and J. W. S. Pringle to a Martin Thackeray studentship.

At Trinity College, Dr. L. Borinski has been elected to a research studentship and W. E. Bennett and D. P. R. Petrie have been elected to Dominion and Colonial exhibitions in physics.

A CINEMA museum, wherein should be housed films of outstanding artistic and scientific merit, is advocated in an article by Elma Dangerfield in a recent issue of *Film Progress*. The project is linked with the scheme of the Shakespeare Film Society formed under the chairmanship of Sir Frank Benson. The same issue of *Film Progress* contains a very informative article by Charles Brawn, which relates how during the past five years he has evolved a successful technique of exhibition of films in schools, and formulates a number of definite conclusions arrived at by the school staff as a result of five years' experience. It seems clear that films are playing an increasingly important part in schools. A glance at a recent issue of a school magazine (*Stoic*, April) shows that the cinema figures prominently in seven separate reports of extra-curricular activities, including those of a natural science society, a natural history society, a film society and a motion picture

club, whilst a section headed "Entertainments" is wholly devoted to reviews of nine films. But, for examples of the most thoroughgoing exploitation of the cinema as an educational agency, one must turn to the schools of Japan. There, not only has every secondary school its motion picture study club, but also a constant flow of new pictures for use as an integral part of classroom work is supplied by the State. These serve both as aids to teaching geography, physics, chemistry, natural history and mathematics and for "fostering national morality through Japanese history. . . . This is the basis of our national education". The quotation is from a statement attributed to the Minister of Education in *School and Society* of March 3.

Science News a Century Ago

Darwin in the Andes

On August 14, 1834, Darwin set out on a riding excursion from Valparaiso. The first day brought him to the Hacienda of Quintero, which formerly belonged to Lord Cochrane. "My object in coming here," he said, "was to see the great beds of shells, which stand some yards above the level of the sea, and are burnt for lime. The proofs of the elevation of this whole line of coast are unequivocal: at the height of a few hundred feet old-looking shells are numerous, and I found some at 1,300 feet. These shells either lie loose on the surface, or are embedded in a reddish-black vegetable mould. I was much surprised to find under the microscope that this vegetable mould is really marine mud, full of minute particles of organic bodies". On the morning of August 16, he started the ascent of the Campana, or Bell Mountain, 6,400 ft. high, and the following day climbed to the top. "We spent the day on the summit," he wrote, "and I never enjoyed one more thoroughly. Chile, bounded by the Andes and the Pacific, was seen as in a map. . . . Who can avoid wondering at the force which has upheaved these mountains, and even more so at the countless ages which it must have required, to have broken through, removed, and levelled whole masses of them? It is well in this case, to call to mind the vast shingle and sedimentary beds of Patagonia, which if heaped on the Cordillera, would increase its height by so many thousand feet. When in that country, I wondered how any mountain-chain could have supplied such masses, and not have been utterly obliterated. We must not now reverse the wonder, and doubt whether all-powerful time can grind down mountains—even the gigantic Cordillera—into gravel and mud."

An Aerial Ship

On August 14, 1834, the *Morning Chronicle* gave a description of the great aerial ship which was then on exhibition on the premises of the Aeronautical Society, Paris, in the Champs Elysées. This novel conveyance consisted of a balloon 134 ft. long, 34 ft. high and about 25 ft. wide. It was in the form of the air-bladder of a fish, rather wide in the middle while the ends were in the form of pointed cones. It was described as capable of lifting 6,500 lb. The car, which was made of wicker-work, painted tri-colour, was 66 ft. long and very narrow, with seats across it at regular intervals. It was fixed immediately under the balloon and it could accommodate thirty persons. The material of which the balloon was

made was prepared in such a way as to preserve the gas for fifteen days. There were rudders at each end of the car and paddle wheels of canvas stretched over light iron frames on either side. The principal projector of this gigantic undertaking was M. Lennox, formerly a superior officer in the French Army. A trial was to have been made on August 15, but it was postponed until August 17. On that day, great crowds assembled to see the gigantic balloon ascend, but at 12.30 p.m., just when the fully-inflated balloon was being drawn down for the aeronauts to embark, it turned upside down and burst with a loud explosion.

The Worcestershire Natural History Society

Referring to the publication of the "Illustrations of the Natural History of Worcester" by C. Hastings, M.D., the *Athenæum* of August 16, 1834, said: "We notice with sincere pleasure this first fruit of the Worcester Natural History Society being the substance of an introductory lecture delivered to them by Dr. Hastings, and including general views, comprehensive and interesting, of the Statistics, Geology, Botany, Zoology and Meteorology of that country. Gladly would we hail the establishment of such a Society in every county in England, as nothing, we conceive, would so decidedly tend to the collection, as well as diffusion of useful knowledge, to binding together all ranks in the pursuit of science, to promoting universal harmony and good will, and to ameliorating the conditions, both of the upper and labouring classes, by making them better acquainted with the necessities, the interests and the feelings of one another."

The Göttingen Magnetic Observatory

The study of terrestrial magnetism in the earlier part of the nineteenth century led to the formation in 1834 of the German Magnetic Union and the erection by Gauss of the Magnetic Observatory at Göttingen. This Observatory and its equipment were described in the number of the *Göttingische gelehrte Anzeigen* of August 1834, a translation of the article being afterwards published in the *Philosophical Magazine*. The observatory was about 100 yards from the Astronomical Observatory, and formed an oblong about 32 ft. by 15 ft. Everything in the building usually made of iron, such as locks, hinges, etc., was of copper, and draughts were prevented as much as possible. The principal instrument was the "magnetic bar made of Uslar cast steel which is particularly fit for magnetical observations". It was 610 mm. in length and weighed about 4 lb. It was suspended from the ceiling by a 200-fold untwisted silk thread, and the inconvenience caused by the stretching of the threads was overcome by an ingenious device due to W. E. Weber, the colleague of Gauss. Besides Gauss and Weber, Ulrich, Goldschmidt, Listing, Sartorius, Deahna and W. Gauss had made observations, while Sartorius had made observations at a country house in Bavaria. The concluding paragraphs of the article refer to the "double line of wires from the cabinet of natural philosophy over the houses of the town to the astronomical observatory", which had been continued to the magnetical observatory, thus forming a chain by which the galvanic current, including the multipliers attached to each end of the chain, has to run through a length of wire nearly 9,000 feet. "This arrangement," it was said, "is likely to produce the most interesting results."

Societies and Academies

DUBLIN

Royal Irish Academy, June 11. A. E. MUSKETT, H. CAIRNS and E. M. CARROTHERS: Further contributions to the fungus flora of Ulster. This paper represents a further contribution to the known fungus flora of Ulster, the first contribution being made in 1931 (*Proc. Roy. Irish Acad.*, 49, Sect. B, No. 2; 1931). It adds 284 species and varieties to the previous records, the total number recorded up to the date of writing being 1,199. A large number of these additions were made during the visit of the British Mycological Society in 1931 when forays were made to some of the better known woodlands. 141 of the species and varieties listed are noted as being new Irish records. Two of the species and one variety constitute new British records. These are *Hygrophorus agathosmus*, Fr. var. *aureofoccosus*, Bres., and *Tulasnella anceps*, Bres. and Syd. Both were recorded during the visit of the Society, the latter being parasitic on *Pteris aquilina*. The other new British record, *Phytophthora Megasperma*, Drechsler, was isolated by one of the writers from a potato tuber affected with pink rot.

EDINBURGH

Royal Society, July 2. W. J. HAMILTON: The early stages in the development of the ferret. (1) Fertilisation to the development of the prochordal plate (studied in living and sectioned material). The living unsegmented and segmented eggs of ferret show a perivitelline space in which vitellus and polar bodies move independently. At fertilisation, the entire sperm enters the ovum. The cells arising from the first division are similar in appearance, but differ in size; statistically this difference is not significant. The cells do not divide synchronously. At the four-cell stage there is a small cell. The blastocyst cavity is intercellular; the central cell mass is composed of a few cells covered with trophoblast and later forms a flattened disc. The endoderm arises by delamination, the cells are at first flattened. A. E. CAMERON: The life-history and structure of *Hæmoptota pluvialis*, L. (Tabanidæ). Commencing with females captured in the field and induced to oviposit in the laboratory, the metamorphosis of *H. pluvialis* is described. It is the first European species of tabanid the life-history of which has been traced and the number of larval instars determined. They were found to vary from seven to nine. The species is uni- or demi-voltine. From the same batch of eggs, individuals were reared that took, some one year, others two years to complete their life-histories, although the conditions of rearing were alike for all. It is suggested that *H. pluvialis* is heterozygous for univoltine or demi-voltine characters. The lava and pupa occur in moist soil. The anatomy of the larva is discussed, including the unique head capsule, the alimentary, tracheal and nervous systems. The peculiar organ of Graber is described in detail, a comparison drawn with that of other tabanid species, and its probable function discussed. The larva and pupa of *H. pluvialis* and *H. americana* are compared. H. H. BROWN: Study of a tectibranch gasteropod mollusc, *Philine aperta*, L. This tectibranch lives in the soft mud of British estuaries, in which it ploughs its way by means of the cephalic disc. This organ is shown, on both comparative anatomical and developmental

grounds, to be formed by the fusion of the two cephalic tentacles. The radula is modified so that it works in the manner of a mechanical grab; the apparatus is protruded from the mouth, and by a sweeping movement of opposing sets of long radular teeth, food is picked up and drawn into the mouth. The animal relies in searching for food upon the rhinophores, and also upon a pair each of cephalic and pedal pit sense organs near the mouth, here described for the first time. The development is traced from the veliger newly liberated from the spawn mass, to a stage which has lost the velum, and has assumed several adult characters, including the cephalic disc and the gizzard. A. GRAHAM: The structure and relationships of lamellibranchs possessing a cruciform muscle. Lamellibranch molluscs which possess a cruciform muscle have hitherto been classified partly as Tellinacea and partly as Solenacea, in which also occur the razor shellfish, which have no cruciform muscle. An investigation of the anatomy of these animals shows that in many points the members of the Solenacea which possess a cruciform muscle, the Solecurtidae, resemble the Tellinacea and differ from the Solenidæ. The differences justify the union of all lamellibranchs with a cruciform muscle in the Tellinacea, leaving the Solenacea including only animals without one. RALPH DENNELL: The feeding mechanism of the cumacean crustacean, *Diastylis bradyi*. The feeding mechanism of *Diastylis* is probably derivable from the primitive mysid arrangement. The powerful respiratory current enters the large carapace antero-ventrally, and flows out through the rostral siphon, the rostral valve opening by water pressure behind it. Movements of the maxillæ and maxillipeds with regard to a peculiar median process produce a filter current, which is aided by the respiratory current. After an examination of *Apeudes* it is hoped to describe the probable evolution of feeding mechanisms along the line leading from some primitive mysid and culminating in the Isopoda. T. M. MACROBERT: Some integrals, with respect to their degrees, of associated Legendre functions. A number of integrals of this type are evaluated by different methods, including contour integration, Fourier's integral theorem and expansions in series.

PARIS

Academy of Sciences, June 18 (*C.R.*, 198, 2129-2216). The president announced the death of Henri Lecomte, member of the Section of Botany. J. CABANNES: The radiations of the night sky in the spectral interval 5000-8000 Å. The results generally confirm those of Sommer. G. MIHOC: Discontinuous multiple chains. JACQUES VALENSI: Trajectories and instantaneous velocities in the field of an aerial screw. D. BARBIER, D. CHALONGE and E. VASSY: The comparison of the continuous spectra of some stars of the A and B types. Nocturnal determinations of ozone. A. FORTIER: The measurement of pressures by the photographic determination of the levels reached by liquids in tubes. J. BERNAMONT: The experimental study of the fluctuations of resistance in a metallic conductor of small volume. Details of experiments with a platinum wire of 1 micron diameter. J. J. TRILLAT and H. MOTZ: The diffraction of electrons by india-rubber. The results obtained by electron diffraction confirm the view, already proved with the X-rays, that stretched india-rubber shows a phenomenon of pseudo-crystallisation.

This effect is unstable and disappears in about 24 hours. It is concluded that the isoprene chains are arranged in the plane of the surface of the film. N. THON: Electrode capacity in the presence of foreign ions and the electrocapillary capacity of mercury. A. ROUSSET: The diffusion of light by binary mixtures in the neighbourhood of the critical point of complete miscibility: measurements of the depolarisation factor. L. HERMAN: The (light) absorption of oxygen between 7000 and 3000 Å. Study of the absorption spectrum of oxygen, in a tube 100 metres long and under a pressure of 10 kgm./cm.². NY TSI-ZÉ and CHOONG SHIN-PIAW: The influence of the electric field on the absorption spectrum of rubidium. HENRYK NIEWODNICZANSKI: An experimental demonstration of the existence of dipolar magnetic radiation. ANDRÉ CHARRIQU and MLLÉ. S. VALETTE: Linear deformations of nitrocellulose films as a function of the atmospheric humidity. In photography from the air, the variations in the linear dimensions of the films interfere with high precision work. The effect of the hygrometric condition of the air on the film has been studied. When the humidity increases 1 per cent the linear dimensions of the films increase 0.01 per cent. H. HULUBEI: Methods of focalisation in the analysis of crystalline powders and in the spectrography of the X- and γ -radiations. W. SWIETOSLAWSKI and B. KARPIŃSKI: The displacement of the azeotropic point of the ternary azeotrope (benzene, ethyl alcohol, water) as a function of the pressure. O. BINDER: The action of aqueous solutions of copper sulphate on cupric oxide. The basic copper sulphate, 4CuO, SO₃, 4H₂O, has the same physical properties (X-ray diffraction spectrum, magnetic susceptibility) whether prepared with blue copper hydroxide or black copper oxide. A. TRAVERS and YU KWONG CHU: The hydration of phosphoric anhydride. The addition of water to phosphoric anhydride, taking every possible precaution to avoid local heating, always gives a mixture of two varieties of metaphosphoric acid, one not coagulating albumen and giving pyrophosphoric acid on hydration, the other more polymerised form, coagulating albumen and hydrating directly to orthophosphoric acid. MLLÉ. AMAGAT: Contribution to the study of the α -di- or trisubstituted amides. M. TIFFENEAU and MLLÉ. I. NEUBERG: The action of phenylmagnesium bromide on levorotatory dibenzoylglyceric aldehyde. The formation of levorotatory α -dibenzoylphenylglycerol. MLLÉ. M. DARMON: Study of the hydration of two phenylglycides: 3-phenyl-2,3-epoxy-2-propanol and 1-phenyl-2,3-epoxy-1-propanol. The formation in each case of the two α and β phenylglycerols. R. LESPIEAU and RENÉ LOMBARD: The preparation of enynols and the passage from these to the dienols. RINGEISSEN: The mobility of the halogen in the α -halogen- β -naphthols. L. PALFRAY and M. ROUBART: Some monoalkoxy ethers of glycol, with high molecular weight. E. BERGER: The aqueous mortars obtained with organic binders. ALBERT F. DE LAPPARENT: The fold of Salernes (Var), its foundation and its connexions with the Lorgues folds. ANTONIN LANQUINE: The structures of the Provençal chains in the south of the Basse-Alps. D. SCHNEEGANS: Preliminary palæontological study of the fossils collected by R. Lambert between Agadez and Zinder (Niger). MLLÉ. F. FLOUS: The notion of phyllorhize in the cork oak. R. J. GAUTHERET: Culture of the cambial tissue. BROULAND: The existence of trachids in the flower of some species

of the family of the Ranunculaceæ. MLLÉ. L. MEYER: The variation of the apparent rH of the soil during the growth of plants. LUCIEN BERLAND: The study with an aeroplane of the aerial entomological fauna. M. and MME. A. CHAUCHARD: The measurement of the cortical excitability by the percutaneous method after craniectomy and cicatrization. P. E. THOMAS and P. DE GRAEVE: Dextrorotatory allantoin, its presence in animals. A. CHEVALLIER, MLLÉ. Y. CHORON and J. GUILLOT: A substance A', intermediate between vitamin A and β -ionone. E. BRÉDO: The microbial and cytolytic origin of turbidities of hygienic drinks. ANDRÉ BOIVIN and MME. LYDIA MESROBEANU: The chemical properties of a toxic and immunising substance isolated from the B. Aerttrycke bacillus.

GENEVA

Society of Physics and Natural History, March 15. W. H. SCHOPFER: An attempt at generalising the action of the growth factor in the Mucorineæ. The accelerating action of extracts of wheat germ and of yeast extracts is seen in all the Phycomyces observed. It is much weaker in other species of Mucorineæ. The vitamin action shows itself equally on the plant development. W. H. SCHOPFER: (1) The action of crystallised vitamins B₁ and B₂ on a micro-organism. The crystallised vitamins, Windaus (B₁) and Kuhn (B₂) act in an intense manner on the development of Phycomyces. In the proportion of 0.05 γ per c.c. of the culture medium, the effect is still felt. (2) The existence in the pollinia of orchids of a growth factor for micro-organisms. The aqueous extract of the pollinia contains a thermostable substance accelerating the development of Phycomyces. P. ROSSIER: (1) Comparison of two criteria of spectral classification of stars. Going up in the series of star spectra, the importance of the ultra-violet diminishes and the width of the K line increases. Even in the spectral class F0 of the Henry Draper catalogue their application gives concordant results. Working on a sufficient number of spectra, measurements of the width of lines or of the length of various parts of the spectrograms give the spectral class. (2) The central wave-length in astronomical spectrography. The author thus names the wave-length which, taken as origin in a stellar spectrogram, makes homogeneous the linear relation which exists between the extremities of the spectrogram. Although differing from the effective wave-length, its behaviour is analogous with that of this quantity. G. GUTZET and R. WEIBEL: The use of the antipyrine-iodide reagent in analysis with the spot test. This reagent can be utilised in qualitative spot test analyses on condition that the arsenic ion is oxidised and that the oxidising effect of the ions at the maximum is avoided by a preliminary treatment of the solution with formol. The antimonous ion can be detected in the presence of other ions of the same sub-group by working according to the author's directions. D. ZIMMET and E. FROMMEL: The action of muscle extract (lacarnol) and of pancreatic extract deprived of insulin (padutine) on the nervous system of the frog. These two products injected into the frog produce irregular movements resembling chorea. Hence it would appear that in addition to their vasomotive action, they have an effect on the central nervous system. G. TIERYCY: The equation of condition for the extremes of ionisation in the peripheral layer of a variable star. The author gives the equation which

must be satisfied before dealing with the phase of maximum ionisation: he expresses the terms as a function of the variation of temperature and of the variation of magnitude.

ROME

Royal National Academy of the Lincei, Feb. 18. F. ENRIQUES: Elliptical surfaces of zero genus. P. BURGATTI: Displacement of the perihelion in the theory of relativity. G. BRUNI and G. NATTA: Structure of guttapercha, studied by electron rays. By the action of electron rays, crystalline or α -guttapercha is rapidly transformed into the amorphous β -form. The α -variety has rhombic or pseudorhombic structure, with the axial ratios 1:1.176:1.47. On the assumption that unit cell contains four isoprene groups, the calculated density is 0.94, which agrees well with the most recent experimental data. A. ROSENBLATT: Non-linear m -harmonic equations with two independent variables. (1) Green's m -harmonic function in the case of the circle. M. GHERMANESCO: Trigonometric sums of Alaci. R. EINAUDI: Propagation of superficial elastic waves. D. GRAFFI: The eccentricity of the orbit in the problem of two bodies of variable mass. D. C. LEWIS, JR.: Periodic oscillations of a dynamic system. L. SONA: Transloculatory current investing a bilateral lamina. L. SOLAINI: A particular case of the problem of the vertex of a pyramid. A. MISSIROLI and A. CORRADETTI: The possibility of the phenomena of hybridism in malarigenic parasites. G. CIACCIO: Regeneration of the crystalline in examples of various ages of *Salamandra maculosa* and regeneration of the crystalline in transplanted eyes of *Triton cristatus*. G. BRUNELLI and G. BINI: The emigration of a species of *Teuthis* from the Red Sea to the Aegean Sea.

Official Publications Received

GREAT BRITAIN AND IRELAND

Experimental and Research Station, Nursery and Market Garden Industries' Development Society, Ltd., Turner's Hill, Cheshunt, Herts. Nineteenth Annual Report, 1933. Pp. 115. (Cheshunt.)
 Education (Scotland). Report for the Year 1933 by the Director on the Royal Scottish Museum, Edinburgh. Pp. 13. (Edinburgh.)
 British Empire Cancer Campaign. Eleventh Annual Report of the Grand Council presented at the Meeting held at the House of Lords, 9-7-34. Pp. xxiii+220. (London: British Empire Cancer Campaign.)
 Imperial Agricultural Bureaux. Fourth Annual Report of the Executive Council, 1932-1933. Pp. 23. (London: H.M. Stationery Office.) 1s. net.
 Transactions of the Institution of Chemical Engineers. Vol. 11, 1933. Pp. 227. (London: Institution of Chemical Engineers.)
 Ministry of Agriculture and Fisheries. The Agricultural Output of England and Wales, 1930-1931: Report on certain Statistical Enquiries relating to the Output of Agricultural Produce and to the Agricultural Industry in general, together with Results of Earlier Enquiries of a similar Nature. (Cmd. 4605.) Pp. 67. (London: H.M. Stationery Office.) 1s. net.
 Falmouth Observatory. Report of the Joint Observatory Committee to the Royal Cornwall Polytechnic Society and to the Falmouth Town Council for the Year 1933. Pp. 3. Meteorological Notes and Tables for the Year 1933, also Additional Meteorological Tables of Temperature, Rainfall and of Sunshine, 1880-1933, and Miscellaneous Phenomena during 1933. Pp. 11. (Falmouth.)
 University of Bristol. The Annual Report of the Agricultural and Horticultural Research Station (The National Fruit and Cider Institute), Long Ashton, Bristol, 1933. Pp. 214+7 plates. (Bristol.)
 The Scientific Proceedings of the Royal Dublin Society. Vol. 21 (N.S.), No. 7: Report of the Irish Radium Committee for the Year 1933; including Reports by Oliver Chance, Dr. W. G. Harvey, W. J. MacHugh and Oswald J. Murphy. Pp. 59-66. (Dublin: Hodges, Figgis and Co.; London: Williams and Norgate, Ltd.) 6d.
 Air Ministry: Aeronautical Research Committee: Reports and Memoranda. No. 1576 (Spin. 107, 138): Spinning of Pterodactyl Mark IV. Part 1, by A. V. Stephens and J. Cohen; Part 2, by A. V. Stephens. Pp. 10+2 plates. (London: H.M. Stationery Office.) 9d. net.
 Amgueddfa Genedlaethol Cymru: National Museum of Wales. Welsh Flowering Plants: a Handbook to the Collection in the Welsh National Herbarium. By H. A. Hyde and A. E. Wade. Pp. vii+179+2 plates. (Cardiff: National Museum of Wales; Press Board of the University of Wales.) 5s.

OTHER COUNTRIES

Bernice B. Bishop Museum. Bulletin 115: Archaeology of Kahoolawe. By J. Gilbert McAllister. Pp. 61+5 plates. Bulletin 116: Stone Remains in the Society Islands. By Kenneth P. Emory. Pp. 182+20 plates. Bulletin 117: Astelia and Pipturus of Hawaii. By Carl Skottsberg. Pp. 77+38 plates. Bulletin 118: Tuamotuan Stone Structures. By Kenneth P. Emory. Pp. 78+10 plates. Bulletin 119: Geology of Vitilevu, Fiji. By Harry S. Ladd. Includes Petrography, by Arthur A. Pegau; Smaller Foraminifera, by Joseph A. Cushman; Larger Foraminifera, by G. Leslie Whipple; Corals, by J. Edward Hoffmeister; Smaller Echinoids, by H. L. Hawkins; Decapod Crustaceans, by Mary J. Rathbun. Pp. 263+44 plates. Bulletin 120: The Flora of Makatea. By Gerrit Parmile Wilder. Pp. 49+5 plates. Bulletin 121: Some Hawaiian Oribatoidea (Acarina). By Arthur Paul Jacot. Pp. 99+16 plates. Bulletin 122: Mangaian Society. By Te Rangī Hiroa (P. H. Buck). Pp. 207. Bulletin 124: Report of the Director for 1933. By Herbert E. Gregory. Pp. 44. (Honolulu.)
 Report of the Aeronautical Research Institute, Tōkyō Imperial University. No. 106: On the Uplift acting upon a Heated Fibre vertically suspended in Gas. By Yositada Takenouti. Pp. 337-384. (Tōkyō: Koseikai Publishing House.) 40 sen.
 Journal of the Faculty of Agriculture, Hokkaido Imperial University. Vol. 26, Part 4: Flora of Hokkaido and Saghalien. 4: Dicotyledoneae, Archichlamydeae, Saururaceae—Polygonaceae. By Kingo Miyabe and Yushun Kudo. Pp. 389-528. (Tokyo: Maruzen Co., Ltd.)
 A Field Study of the Behavior and Social Relations of Howling Monkeys. By C. R. Carpenter. (Comparative Psychology Monographs, Vol. 10, No. 2.) Pp. 168 (16 plates). (Baltimore, Md.: Johns Hopkins Press.) 2.25 dollars.
 Meddelanden från Statens Skogsförsöksanstalt. Häfte 27, 1932-34. Pp. v+379. (Experimentalfältet.)
 Svenska Linné-Sällskapetets Årsskrift. Årgång 17, 1934. Pp. xii+151. (Uppsala.)
 Kungl. Svenska Vetenskapsakademien Handlingar. Serien 3, Band 13, No. 3: Northern and Arctic Invertebrates in the Collection of the Swedish State Museum. 12: Tunicata, 4: Clonidae, Ascidiidae, Agnesidae, Rhodosomatidae. By Dr. Augusta Årnäck-Christie-Linde. Pp. 91+6 plates. Serien 3, Band 13, No. 4: Systematische und biologische Studien über die Termiten Javas und Celebes'. Von N. A. Kemner. Pp. 241+22 plates. Serien 3, Band 13, No. 5: On the Heads of certain Arthrodes. 1: Pholidosteus, Leiosteus and Acanthaspides. By Erik Åson Stensiö. Pp. 79+14 plates. Serien 3, Band 13, No. 6: Catalogue of Aurora borealis observed in Northern Sweden during the Time August 1932-March 1933. By Axel Corlin. Pp. 51. (Stockholm: Almqvist and Wiksells Boktryckeri A.-B.)
 Paleontologiese Navorsing van die Nasionale Museum, Bloemfontein. Deel 2, Stuk 6: Oor die Indeling van die Dicotyledonidae na Aanleiding van Nuwe Vorme. Deur Dr. Ir. E. C. N. Van Hoepen. Pp. 67-101. (Bloemfontein.)
 Science Reports of the Tokyo Bunrika Daigaku, Section B. No. 19: Sur une nouvelle espèce du genre *Paracerorchis* (Trématode) parasite de la tortue d'eau douce *Clemmys japonica*. Par Tamao Fukui et Tōji Ogata. Pp. 203-211. 15 sen. No. 20: *Telorchis konoi* n.sp. (Trématode) parasite de la tortue d'eau douce *Geoclemmys reevesi*. Par Tōji Ogata. Pp. 213-219. 15 sen. No. 21: Weiteres über den isoelektrischen Punkt der Bakterien. Von G. Yamaha und S. Abe. Pp. 221-229. 15 sen. No. 22: On the Range of Lethal Body Temperature of the Rat. By Nobumasa Yagi and Jukichi Shimoizumi. Pp. 231-242. 20 sen. No. 23: Über die Bildung der Urease bei *Aspergillus niger*. Von Tomoo Miwa und Seichirō Yoshii. Pp. 243-270. 30 sen. No. 24: Contribution to the Study of Japanese *Arenicola*. Part 1: Notes on the Habits and Distribution of *Arenicola* in Japan. By Keizo Takahashi. Pp. 271-279. 20 sen. (Tokyo: Maruzen Co., Ltd.)
 Publications of the Washburn Observatory of the University of Wisconsin. Vol. 15, Part 5: Space Reddening in the Galaxy from the Colours of 733 B-Stars. By Joel Stebbings and C. M. Huffer. Pp. 217-259. (Madison, Wis.)
 The Comparative Anatomy of Extra-Chromosomal Types in *Datura stramonium*. By Edmund W. Sinnott, Helen Houghtaling and Albert F. Blakeslee. (Publication No. 451.) Pp. iii+50+19 plates. (Washington, D.C.: Carnegie Institution.)
 Brooklyn Botanic Garden Record. Vol. 23, No. 2: containing the Twenty-third Annual Report of the Brooklyn Botanic Garden, 1933. Pp. 170. (Brooklyn, N.Y.)
 Proceedings of the Academy of Natural Sciences of Philadelphia, Vol. 86. Description of New Birds from Peru, with Notes on the Nomenclature and Status of other little-known Species. By M. A. Carriger, Jr. Pp. 317-334. Zoological Results of the Third De Schauensee Siamese Expedition. Part 5: Additional Fishes. By Henry W. Fowler. Pp. 335-352. (Philadelphia.)
 Field Museum of Natural History. Zoology Leaflet 13: Sculptures by Herbert Haseltine of Champion Domestic Animals of Great Britain. Pp. 45. (Chicago.) 25 cents.
 Statens Meteorologisk Hydrografiska Anstalt. Årsbok, 13, 1931. vii. Meteorologiska iakttagelser i Riksgränsen. Pp. ii+49. 4.00 kr. Årsbok, 14, 1932. vi. Aerologiska iakttagelser i Sverige. Pp. 15. 3.00 kr. Årsbok, 15, 1933. ii. Månadsöversikt över väderlek och vattentillgång jämte anstaltens årsberättelse. Pp. 90. 2.50 kr. Årsbok, 15, 1933. ii. Nederborden i Sverige. Pp. 56. 2.50 kr. (Stockholm.)
 Government of India: Department of Industries and Labour. Functions and Organisation of the India Meteorological Department, 1934. Pp. 23. (Simla: Government of India Press.)

CATALOGUES

A Catalogue of Books and Periodicals on Botany. (No. 492.) Pp. 38. (London: Bernard Quaritch, Ltd.)
 Chance-Parsons Optical Glass. Pp. 18. (Birmingham: Chance Brothers and Co., Ltd.)
 The Finch Electron-Diffraction Camera. Pp. 10. (London: Adam Hilger, Ltd.)
 Industrial Thermometers, Hygrometers, Pressure Gauges. (List No. 586.) Pp. 60. (London: C. F. Casella and Co., Ltd.)