NATURE

SATURDAY, JULY 17, 1926.

CONTENTS.

Editorial and Publishing Offices:
MACMILLAN & CO., LTD.,
ST. MARTIN'S STREET, LONDON, W.C.2.

Editorial communications should be addressed to the Editor.
Advertisements and business letters to the Publishers.

Telephone Number: GERRARD 8830.
Telegraphic Address: PHUSIS, WESTRAND, LONDON.

NO. 2959, VOL. 118]

Bird Protection in Great Britain.

THE re-introduction to the House of Lords a few days ago of a Bill for the Protection of Wild Birds suggests a glance at some aspects of bird protection in Great Britain. The new Bill proposes to repeal the Statutes, nine in number, extending from 1880 to 1908, which regulate the legal protection of birds in this country, and to replace them by a single body of law more in keeping with present-day notions of bird protection, and in some respects more stringent in its defence of the birds and more exacting in the penalties to be demanded from law-breakers.

This consolidation of bird protection legislation is a welcome move, for the multiplicity, and to some extent confusion, of the old laws militated against their successful working, and unfortunately the need for rigorous protection is still clamant. During the present season we have had the unedifying spectacle of a well-known naturalist and observer being heavily fined for abetting in the taking of clutches, twenty-three eggs in all, of the crossbill in Norfolk. In the Grampians, Mr. Seton Gordon found that the golden eagle's eggs which he had under observation were taken from the eyrie after they had been incubated for nearly five weeks, that is to say, when the chicks were on the point of hatching and the eggs could have been of no value to the collector. These cases are symptomatic of a vast amount of raiding of the nests of the rarer birds which is taken part in and encouraged by unscrupulous collectors who have the audacity to put science in the forefront of their excuses. It is almost impossible, however, for the law unaided to check such misdemeanours. They will be discouraged and arrested only when public opinion makes its voice heard with no uncertainty in the matter.

It is gratifying to know that public opinion is awakening to the realities of the situation and that steps have been and are being taken, by the Government, by municipalities, and by private bodies, which should go a long way to arouse interest in a vast section of the public which has few opportunities of observing Nature at large. To the enthusiasm of Sir Lionel Earle, chairman of the Bird Sanctuaries Committee (England), was largely due the formation of that committee, under H.M. Office of Works, and the institution, following on the report of the committee issued in 1922, of bird sanctuaries in the Royal Parks in London. The report for 1925, just issued, shows that the sanctuaries continue to give great encouragement to bird life, and that efforts are continually being made, by increasing the amenity of the reserves from the birds' point of view, to encourage the influx of greater numbers and greater variety of wild birds. Supplementary reports dealing

with the sanctuaries at Hyde Park, Kensington Gardens, Richmond Park, Bushey Park, Greenwich Park, St. James's and Green Park show not only that the reserves were largely used as resting-places by birds on migration, but also that a very considerable variety of wild birds took up their summer residence there. At least 18 species nested in Hyde Park and Kensington Gardens, 47 in Bushey Park, and 55 in Richmond Park.

There can be no doubt that a great part of the success of a small sanctuary depends upon the selection of the proper vegetation, and that the steps taken by the Bird Sanctuaries Committee, with the view of offering an attractive food supply to winter migrants, and suitable shelter for summer residents, have done much to ensure the increasing success of the sanctuaries in the Royal Parks. These steps include the planting of berry-bearing trees and of suitable nesting bushes for summer residents, the thinning out of plantations in order that wild flowers, such as foxgloves, willow-herb, and thistles, may grow and seed, and the sowing of teazles, a winter food particularly favoured by goldfinches.

In Scotland, similar steps have been taken in the Royal Park of Holyrood, where Duddingston Loch with its extensive reed-beds, a much-frequented winter haunt of immigrant ducks, promises to become a reserve of outstanding interest. During the present season, it is recorded by Mr. Kirke Nash that the common pochard, which has not hitherto been known to nest in Midlothian, has reared two broods on the Loch.

In several cases city corporations have taken part in the sanctuary movement, the lead having been taken in Scotland by Glasgow, which has created bird reserves, with feeding-tables and so on, in its public parks. The movement is well fitted to stimulate public interest, for it affords new and hitherto unattainable opportunities to town-dwellers for the observation, if not of nests and eggs, at any rate of adult and young birds at the most interesting stage of their existence. Furthermore, it places before the minds of all and sundry, with steady insistence, the facts that birds have an interest and afford pleasure, and that they require protection. The extension of the municipal formation of bird sanctuaries in public parks is a movement worthy of every encouragement because of its possibilities in moulding a wide appreciation of living things; but it must be recognised that such steps can have no bearing on the pressing question of the protection of the rarer birds which are threatened by the attention of the collector.

For the progress made, no body deserves more credit than the Royal Society for the Protection of Birds. The annual report of this influential society indicates the part taken by the Society's watchers in ensuring the safe breeding in certain localities of some of the rarer birds, such as choughs, Kentish plover, Norfolk plover, Dartford warbler, phalaropes, and others. It points out to how great a degree the extension of motor traffic, the breaking up of great estates, and expansive building, are gradually obliterating woods, parks, and meadows, and spreading disturbance in the countryside. In the result, the homes, haunts, and food supplies of wild birds are being altered, and a steady change is taking place in the character, though not in the numbers, of the bird population. It points out that the destruction of sea-birds caused by the deposition of oil at sea, either as waste from oil-driven ships or as cleanings of tankers, is a problem that still seems far from solution, in spite of the three-mile limit imposed upon such discharge by law. But several nations have taken up this matter with energy, and sooner or later some means may be found through international action of avoiding needless destruction.

The report states that afforestation, which had become an imperial necessity, gave many a qualm to the lover of natural woodlands not planted for profit or grown for the axe. In this connexion, the Government could not do better than emulate the action of the various States of Australia, which automatically convert forests under the charge of Government departments into wild animal reserves. Were similar measures taken in Great Britain with regard to the Government afforestation areas under the control of the Forestry Department, a first and important step would be made towards the protection of the rarer birds and beasts, and towards the realisation of that national park which Britain alone amongst the great nations still lacks.

JAMES RITCHIE.

Physiological Optics and Psychology.

Helmholtz's Treatise on Physiological Optics. Translated from the third German edition. Edited by Prof. James P. C. Southall. Vol. 3: *The Perceptions of Vision.* Pp. xi+736+6 plates. (Ithaca, N.Y.: Secretary, Optical Society of America, Rockefeller Hall, 1925.) 7 dollars.

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

THE issue of this volume completes a great task. The English-speaking public has now at its disposal for the first time an edition in English of the epoch-making work of von Helmholtz as it originally appeared, along with the new material which was included in the third German edition to bring the work up-to-date, and some additional matter specially

included in the American edition. In the present volume, this additional matter, contained in two notes by von Kries, one on the perception of depth, the other on visual rivalry, is less in amount than the corresponding matter in the first two volumes. But the whole volume is considerably larger than either of the others, and about one-third of it is occupied by the notes and the appendix contributed by von Kries, on almost every branch of the subject dealt with, which were added to the third German edition of the text. The notes appear at the ends of the several divisions of the subject, and the appendix is given at the end of the volume. It deals with the nature of the idea of space in general, the relations of normal localisation, localisation and anomalous eye adjustment, learning to see, and forgetting, the physiological foundations of judgment and learning, empiricism and nativism or intuitionalism, the origin of the laws of the ocular movements, historical and critical comments, and the theory of binocular instruments.

The whole subject of physiological optics involves physical, physiological, and psychological questions. The present volume deals specially with the latter and the phenomena which give rise to them. In this department, as in the other two which were specially treated in the first and second volumes, Helmholtz was a pioneer. Much time has elapsed since he wrote his discussion; and it might be expected that much, perhaps radical, change of view may have taken place especially where opposing theories were concerned. Helmholtz realised his position clearly. "It ought to be said in the beginning," he remarks, "that our knowledge of the relevant phenomena is still too limited to justify us in acceptance of any one theory to the exclusion of all the others." "I acknowledge that we are still far from a real scientific comprehension of psychic phenomena." "I frankly admit, however, that these questions under discussion are not altogether ready for final decision. My own attitude to them is due partly to the simplicity of the explanations that are afforded in this way, but especially to systematic considerations also; for I think it always advisable to explain natural processes on the *least* possible number of hypotheses and on those which are as *definitely formulated* as possible." Here we have Helmholtz's creed, which we have already recognised (NATURE, vol. 114, p. 887, vol. 116, p. 88) in rigid application in the physical and the physiological tracts of the subject, carried over scrupulously into the less well-charted psychical region—simple postulation, simple formulation, simple explanation, appeal to facts. "To the solid ground of Nature trusts the mind which builds for aye."

In accordance with this undeviating search for truth as tested by its outstanding characteristics, in accordance with this systematic presentation of it in a form of statement the most easily testable, is there also to be found, in this volume as in the other two, the impress of the hall-mark of time, stamping it as the enduring creation of genius? In answer we need only select, almost at random, words of von Kries, the writer of the notes and the appendix which review and estimate the further advance of the subject during half a century. He takes, in one respect at least, a line of thought differing from that of Helmholtz, but his words are such as these.

"Helmholtz's classical work, published more than forty years ago, was based partly on philosophical considerations, partly on comparatively simple results of direct self-observation, and, partly too, it should be added, on a vast amount of empirical observation in the ordinary sense. But even in this latter respect, in spite of many new facts that have been gleaned and some corrections that have to be made here and there, the material contained in the first edition of the 'Physiological Optics' may still be said to be essentially correct and pertinent."

"Those points in regard to localisation where we have been obliged to differ from Helmholtz (or rather, strictly speaking, where it was found necessary to develop his theory further) are only of secondary importance after all, no matter how much weight may be attached to them."

"It would be therefore a complete misapprehension of Helmholtz's views (as has been intimated sometimes) that he meant to deny altogether the participation of innate factors in the case of localisation. The truth is, rather, that Helmholtz was disposed to think that from his point of view it was extremely probable that there was some kind of co-operation such as we have deemed likely; that is, with respect to the relationship existing between the visual direction and the location on the retina, although he doubted whether such an assumption could be absolutely verified. The fact that modern investigations of strabismus have enabled us to develop still further assumptions of this sort need not imply that any fundamental modification has been made in Helmholtz's theory."

"The main thing to be remembered is that to a great extent these modern investigations have *corroborated* in a very positive manner inferences that Helmholtz had already made from the scant material at his disposal at that time. The main conclusions which he reached have been shown to be absolutely probable."

"The facts tend to support the fundamental conceptions of an empirical theory to a remarkable degree, although perhaps not altogether to the extent that Helmholtz supposed. It would be turning things upside down, it seems to me, to regard these new facts as a corroboration of the points of view of the intuition theory. They are certainly the opposite of what might be anticipated on the basis of those conceptions."

"After all, naturally disposed as I am to agree with many of my *confrères* and to regard learning as being a physiological process, I never have been able to consider this as amounting to any profound or fundamental divergence from Helmholtz's views."

"Helmholtz was absolutely right in disputing the very principle on which the whole nativist conception was based."

"It was stated at the outset (and the fact has been brought out still more clearly in the course of this discussion) that it would be a mistake to think of nativism and empiricism as two mutually antagonistic conceptions involving a choice one way or the other. Experience is placed in the foreground in the empirical theory, and innately determined relations in the intuition theory; and undoubtedly (speaking perfectly generally) both of these things have something to do with our perceptions of space. Here, if anywhere, it will be true that there is a certain amount of justification for each of the two originally conflicting opinions, according to the degree of importance that was attached to one or the other of these things."

"Any one who will follow the argument as here presented will see that the principle which has guided us, and which remains still to-day the best way of obtaining an insight into those problems and is the basis of future investigation, has been the empiricism of Helmholtz, even though it has had to be modified and amplified in many respects."

In the development of any scientific subject, fundamentally unprovable postulates have to be made. In the present case these are the postulates of the innateness of certain ideas or intuitions. The aim in all sciences is to reduce these to a minimum, and Helmholtz, in his development of the subject, strove to push the unexplained intuitional basis as far back as possible. There are three ways in which the expression of conditions may be made in regard to vision: the physical, the physiological, and the psychical. Each of these is equally fundamental and contributive. Each, if the interconnexions were given, is equally valid and available for the expression of the ultimate laws and explanations. Yet Helmholtz's use of the psychological mode of description of the phenomena, for example, especially in regard to phenomena of colour contrast, has been decried as a subterfuge and an error. "The more attentively I have studied the phenomena," he says, "the more I have been impressed by the uniformity and harmony everywhere of the interplay of the psychic processes, and the more consistent and coherent this whole region of phenomena has appeared to me." The whole of his psychic treatment of the phenomena of colour contrast, far removed from the exclusion of future development, can be expressed in mathematical symbols and equations involving the external stimuli and the threshold values which sum up the effects of the internal physical, physiological, and psychic activities.

No mistake is made by von Kries in this connexion. He says: "Some brief allusion may be made to the utter inaptness of an opinion which is sometimes expressed, namely, that, since Helmholtz's views were *psychological*, they had put an end to all further investigation." "In fact we owe it to the 'empiricists' and not to the 'nativists,' that a new and fruitful line of inquiry has been started by studying strabismic vision, for instance." "On the other hand, the feature of the nativist systems that aroused Helmholtz's special opposition must also be pronounced unsound and untenable at present."

Recognition should be made of the unusually fair and careful way in which von Kries states his own views when they differ from those of von Helmholtz. He has attained to that absolute impartiality which is so difficult to reach even in scientific discussion. Alike in judicial fairness, in acuteness of perception, and in concise clearness of expression, his work is worthy of its place alongside that of the master.

The editor of this edition, along with his band of able co-workers, are to be congratulated on the completion of the task of translation. Resting from their labour, they can await the award. For the issue of this edition cannot fail to have its influence on future work in the field with which it deals. It is fitting that its home should be in America, for a strong group of the workers dwells there; but it should, and will, go out into all the world. W. PEDDIE.

The Future of America.

(1) *Midas: or, The United States and the Future.* By C. H. Bretherton. (To-day and To-morrow Series.) Pp. 96. (London: Kegan Paul and Co., Ltd.; New York: E. P. Dutton and Co., 1926.) 2*s.* 6*d.* net.

(2) *Atlantis: America and the Future.* By Colonel J. F. C. Fuller. (To-day and To-morrow Series.) Pp. 96. (London: Kegan Paul and Co., Ltd.; New York: E. P. Dutton and Co.; n.d.) 2*s.* 6*d.* net.

THESE two small books on a great subject are included in the "To-day and To-morrow" series, designed by the publishers to provide a stimulating survey of the most modern thought in many departments of life. Both are accordingly written in a critical and provocative style, compact with aphorisms. America's place in the world is assured and no resentment will be felt there at attempts to discover chinks in her formidable armour. Of the two books, Mr. Bretherton's is the longer and more careful study. Colonel Fuller's suggests the rapid travel impressions of a writer possessing a mature knowledge of world-history.

What is the basis for the strong and not altogether comfortable feeling that America is destined to exercise a powerful influence on the future of the world? The American, "the new white man," marches round the world with his war drum and the European falls in behind "with many a backward glance at the good old days." Nevertheless, the achievements of the United States in art, literature and science are unimportant in relation to their wealth and population. Jazz music and the skyscraper are "the only two new art forms" which Mr. Bretherton is prepared to concede to America as contributions to civilisation. As to their education, the United States, he says, have countless universities but no educated class "outside of their college professors, who rank in the social scale a little higher than the average preacher, and a little lower than the average bootlegger." The matter can be tested by the output of books. "More books on natural history, botany and country life generally are published every year in England than have been published in the United States since the *Mayflower* landed there. The same is true of almost every other branch of literature outside of fiction."

As to forms of government, were we not given to understand that America wished to make the world safe for democracy? Mr. Bretherton produces no evidence of any genuine enthusiasm for democracy. Professional politicians, fanatics with a mania for inhibitions, bosses and spellbinders pullulate. The American reacts by forming the habit of acting, thinking, living and believing 'by numbers.' Prohibition, it is well known, does not prevent an American from getting a drink. But this necessitates a mental process. "He will in the end decide that it is simpler (and more profitable) to stay dry and reserve his mental processes for money-making." So with Fundamentalism. The vast majority of American people, Mr. Bretherton asserts, are reconciled to evolution and have no quarrel with science, which scatters machines and fertilisers with a fatherly hand. Fundamentalism will 'win through' because big business will decide that the man-machine who pauses intermittently from wielding his shovel to ask himself unanswerable questions about the macrocosm is a shade less efficient—say by one-tenth per cent.—than if he accepted "the Bible as written." "The most striking thing about the young Americans of to-day," says Mr. Bretherton, "is that they know nothing and have no ideas of their own." They are forgetting how to think. Like goldfish, they chase feverishly round a glass globe, seeming in some mysterious way to be unaware of one dimension. Their industry is amazing, whether in money-making or in ticking off the sights of Europe in Baedeker.

Significantly, neither author attempts a chapter on American humour, perhaps because it would have resembled the famous chapter on snakes in Ireland. The discussion of the American woman seems inadequate to the importance of the subject. Mr. Bretherton regrets her limited output of poetry, fiction and ephemeral literature. Colonel Fuller is captivated by her charms, contrasting her favourably with her brothers, who appeared to him "gross, ill-mannered, and in their straw hats and trouser belts more or less offensive to the eye."

The question obtrudes—How will it all end? It would be unfair to the authors to reveal their conclusions. Both recognise that something will happen some day when America is disillusioned about the power of money and the booster's curve approaches horizontality, its tangent vanishing like the Cheshire cat. The fate of Rome is not reserved for America, for the simple reason that there are no barbarians to rush in and submerge the American counting house and lobster palace "in one red burial blent." Authors who attempt to foretell the future of America in a hundred years are on safer ground than men of science who predict the position of an unknown planet or the properties of an undiscovered element. Their work should be encouraged, for the national tendencies which they explore have their bearing on our daily life. Possibly the jazz music wafted across the Atlantic sounds a clarion bugle-call if we would listen and interpret.

T. LL. H.

Colloid Chemistry.

(1) *Das kolloide Gold.* Von R. Zsigmondy und P. A. Thiessen. (Kolloidforschung in Einzeldarstellungen, Band 1.) Pp. x + 229. (Leipzig: Akademische Verlagsgesellschaft m.b.H., 1925.) 14 gold marks.

(2) *Das kolloide Gold in Biologie und Medizin: die Goldsolreaktion in Liquor Cerebrospinalis.* Von Dr. Ernst Joel. (Kolloidforschung in Einzeldarstellungen, Band 2.) Pp. viii+115. (Leipzig: Akademische Verlagsgesellschaft m.b.H., 1925.) 7·50 gold marks.

(3) *Einführung in die Chemie der polymeren Kohlenhydrate: ein Grundriss der Chemie, der Stärke, des Glykogens, der Zellulose und anderer Polysaccharide.* Von Prof. P. Karrer. (Kolloidforschung in Einzeldarstellungen, Band 3.) Pp. ix+295. (Leipzig: Akademische Verlagsgesellschaft m.b.H., 1925.) 7·50 gold marks.

(1) THIS is the first of a new series of monographs on colloid chemistry, and the preface, signed by Prof. Zsigmondy alone, serves as a general introduction of the enterprise. The distinguished author deals somewhat severely with certain tendencies which

he discerns in the rapid development of the discipline during the last twenty years; the failure of authors to maintain the standard expected from workers in the field of exact science; a preference for philosophical treatment and undue generalisation; neglect of the chemical nature of the systems investigated, and other shortcomings. Against these has to be set much exact work carried out by isolated investigators, and the object of the series is to collect and co-ordinate such work and to make it generally accessible.

The first volume may certainly be said to have achieved this object; it contains everything worth knowing about gold sols. The methods of preparing them, which are due to the author, are described in every detail, and the necessity of strict adherence to these directions is duly emphasised. Their electrical and optical properties are then treated exhaustively, as well as a number of phenomena which, while not specific to gold sols, have been largely studied on this material; such are coagulation velocity and protection. The chemical composition of the sols is also discussed at length, and the author produces ample evidence to show that stable sols need not contain oxygen; a result which contradicts the view held—at least at one time—by Pauli and his school, that 'aurate' complexes impart the negative charge to the gold particles.

The volume illustrates the important part played by the study of gold sols in the development of modern colloid physics and chemistry. That this study leaves untouched some of the most important and difficult problems in this field, such as viscosity and solvation, is worth pointing out to students who are invariably attracted by the ease with which gold sols—of sorts—can be made and by their somewhat spectacular properties.

(2) Dr. Ernst Joel's volume deals with a highly specialised application of gold sol: the Lange method of diagnosing luetic and meningitic infection in the cerebro-spinal fluid. The protective effects of these morbid fluids differ from that of the normal and from one another, so that they can be distinguished by coagulating gold sol with sodium chloride in the presence of the fluid, of course in strictly defined ratios and conditions. By way of introduction the author gives a lucid and detailed account of the phenomena of protection by proteins and protein mixtures, and of the related phenomenon of sensitisation of these bodies. Critical application of this vast and difficult evidence to the Lange reaction seems to lead to the conclusion that the essence of the difference in the three types of fluid is a shifting of the albumin-globulin ratio.

(3) Although the eminently colloidal character of the polymerised carbohydrates has never been in doubt, their systematic study by modern methods has, until recently, lagged far behind that of the proteins. Some impetus has no doubt been given to it during the last decade by the enormously increased importance of cellulose and its esters in the arts of peace and war. The volume under review deals very exhaustively with starch, glycogen and cellulose; other carbohydrates receive briefer but adequate mention. The point of view is largely that of the organic chemist, structural formulæ being discussed at great length; the aspects which particularly interest the colloid chemist, such as apparent molecular or 'micellar' weights, are, however, not neglected. He will, at any rate, find here ample information regarding the chemical character of his materials which will enable him to approach one of the great tasks of the future—the co-ordination of colloidal properties with chemical constitution.

All three volumes are excellently printed and well bound, and the student of colloids who wishes to keep his library complete will have to face the purchase of these and of subsequent monographs in the series.

Aspects of the Oceans.

A Study of the Oceans. By Prof. James Johnstone. Pp. viii+215. (London: Edward Arnold and Co., 1926.) 10*s*. 6*d*. net.

LIVERPOOL is distinguished amongst British universities by the possession of a chair of oceanography from which Prof. Johnstone speaks as an exponent of the science. The subject naturally appeals most strongly to a seafaring people in those practical aspects which affect navigation, cable-laying, fisheries and the like; but Prof. Johnstone very wisely takes a wider view in opening out vistas of geological evolution and historical discovery. These considerations, rightly balanced, should serve to place the subject on a wide academic basis. The exact purpose of the book before us is not stated, but the seven chapters read like a series of semi-popular lectures each so far complete in itself as to involve a certain amount of repetition, not unhelpful to students though detracting in some degree from the close-knit unity which one looks for in a scientific treatise.

The elements of the book are rather difficult to blend. The first chapter deals with an advanced modern problem, the geological history of the oceans, and the next two with the speculations of the ancient Greeks and the history of nautical discovery since the time when the Mediterranean was 'The Great Sea.' The four remaining chapters deal from both points of view with the circumpolar regions, the Atlantic, the Pacific and the Indian Oceans respectively. The difficulty of

developing such a plan is obvious. It might have furnished a satisfactory course of University Extension lectures delivered with the animation of an enthusiast to an eager audience, and some passages (*e.g.* p. 122) suggest that, like Huxley's "Physiography," the book owes its literary form to notes taken from extempore speaking. If, however, the object was not to stimulate general interest but to guide serious study, a more systematic treatment and more sedulous revision would have done fuller justice to the author's wide knowledge.

No one can bring a great subject within the compass of a small book without leaving out much which is really of importance. Hence an author should not be taxed with omissions which he probably recognises and regrets; still, it is surprising to find that even so brief a history of the oceans as this could be written without mentioning the name of Maury. The publication of Maury's "Physical Geography of the Sea," in 1855, seems to many of us to have been the launch of the modern science of oceanography, and the memory of the great American sailor deserves to be kept alive.

I confess that I do not know enough of geology or ancient history to pass an opinion on the exposition of these subjects, but I do venture to question Prof. Johnstone's subdivision of the oceanic depression (p. 11) into *Continental Shelf* and *Ocean Bed* with the boundary between the two taken as the line of 1000 fathoms. If room could have been found for a notice of the hypsographic curve, the advantage of a more detailed subdivision of the ocean floor and slopes would probably be recognised. Even granting that the 1000 fathom isobath is to be taken as a physical boundary, it is unfair to give to the region on its landward side the name of the Continental Shelf. Most other oceanographers have accepted that term as meaning the gently sloping zone covered by shallow water extending from low-water mark to a depth of about 100 fathoms, or in rare cases, as on the Antarctic coasts, to 200 or 300 fathoms. It corresponds to the old nautical 'in soundings,' and at its deeper end there is always a sudden increase in the gradient of the Continental Slope which leads to the ocean depths. When I introduced the term in 1888, I was impressed by the wide flat expanse of the Vidal Bank west of Scotland, and recognised that it was not a local but a world-wide feature of the transitional area between land and the deep sea. Prof. Johnstone has no doubt excellent reasons for departing from the international nomenclature settled for the great Monaco bathymetrical chart, and he may have stated them in some work with which I am not familiar. It would, however, have saved confusion and perhaps perplexity if he had chosen for this zone covered with water from 0 to 1000 fathoms deep, a name which was not already in use for a definite and restricted portion of the area which he includes within it.

The book has the advantage of a good index and a brief bibliography, which might well have been supplemented by reference to the foreign literature of the subject. HUGH ROBERT MILL.

Our Bookshelf.

Ancient Greece at Work: an Economic History of Greece from the Homeric Period to the Roman Conquest. By Prof. Gustave Glotz. Translated by M. R. Dobie. (The History of Civilisation Series.) Pp. xii+402. (London: Kegan Paul and Co., Ltd.; New York: Alfred A. Knopf, 1926.) 16*s.* net.

IN "Ægean Civilisation," a previous volume in this series, Prof. Glotz traced Mediterranean culture from its beginnings to its culmination in Minoan Crete and its decline on the mainland. To present as complete a picture as possible he sketched such an outline of the social organisation of these early periods as may be deduced from archæological remains, eked out with evidence from other sources. In the present volume he takes up the social and economic story of Greece at the point where the previous volume ended. Beginning with the pastoral society of Homeric times, he traces the development of social and economic organisation through the archaic period, the predominance of Athens, and Hellenistic times. Each period has its peculiar characteristic and, as he points out, no general statement is applicable to Greek economics as a whole, but only with special reference to some one of these periods.

Those who are not already familiar with the data will probably be surprised at the amount of information Prof. Glotz has been able to gather together relating to the early Homeric period. The manner in which he extracts his material from incidental references and allusions in the Iliad and Odyssey commands our sincere admiration. At the same time, his deductions are capable of being checked by comparison with what we know of pastoral societies elsewhere which are organised in groups similar to the Greek *gene*. The archaic period, notwithstanding that evidence of a more direct character is available, is really more obscure. The treatment of the period of the Athenian hegemony is illuminating. It is, of course, recognised that slavery is the essential factor in the social and economic organisation, but it is especially in relation to the position of the metics that Prof. Glotz is most suggestive. Is it not possible that the influence of this element in the population in the subsequent development of the characteristics of the Greek people has been underrated?

The Chemistry of Drying Oils. By Dr. R. S. Morrell and H. R. Wood. (Oil and Colour Chemistry Monographs.) Pp. 224. (London: Ernest Benn, Ltd., 1925.) 21*s.* net.

CHEMICAL industry has become so highly specialised that at the present day it is practically impossible for one person to write from first-hand knowledge a trustworthy text completely covering even one industry. It is only by a series of monographs continually being

brought up-to-date and written by experts with direct knowledge of particular processes that detailed information of real value can be secured. Under the editorship of Dr. Morrell we have an example of such a series of monographs for the oil and colour industry of which the volume under notice forms a part.

The expression and extraction of linseed and other less known oils from their seeds, the refining and bleaching of these oils as well as the preparation of boiled, blown and stand oils, receive detailed treatment. The use of these oils in the manufacture of linoleum and patent leather and the employment of drying oils as electrical insulators receive detailed consideration. The aim has been to give a trustworthy account of the most recent information regarding various processes and methods, with a critical survey of the literature by works' experts. Notwithstanding the bias towards the industrial aspect, stress has been laid by the authors on the importance of physical properties in relation to chemical changes. The composition of drying oils and their component acids, with the chemical changes occurring on drying, have been exhaustively treated before discussing manufacturing details. A valuable addition is the good list of references at the end of each chapter.

The book is excellently produced, and in fact for a monograph that will require frequent editions to keep abreast of practice, the finish is, if anything, too durable. The high price of this book, with only 200 pages of text, makes such a remark pertinent. J. REILLY.

Three Men Discuss Relativity. By J. W. N. Sullivan. Pp. xxx+233. (London and Glasgow: W. Collins, Sons and Co., Ltd., 1925.) 7*s.* 6*d.* net.

MR. SULLIVAN has achieved something new in the exposition of relativity by writing in dialogue form. One is inevitably reminded of Galileo, but in Mr. Sullivan's book, unlike that of the great Florentine, the characters are not provided with conflicting preconceptions. They are, in fact, not private individuals so much as actors whose parts are made to fit together in such a way as to provide a smooth, uninterrupted account of the theory for the reader. After a brief introduction, six dialogues are set forth, between a mathematical physicist, a philosopher, and an ordinary intelligent person. The mathematical physicist has undertaken to expound the theory of relativity to his companions, who make just the right remarks or ask appropriate questions at frequent intervals. It must be confessed that the ordinary intelligent person is much more intelligent than the sort of person one ordinarily meets with.

From an artistic point of view, the dialogue method as here employed can scarcely be regarded as successful. It does, however, add considerably to the interest of the exposition, and is on that ground justified. The mathematical detail of the subject is almost completely excluded from the dialogues and given in a 45-page summary at the end. Those who wish to obtain an accurate idea of relativity in rather more than its outline and are prepared to expend some mental effort, can do no better than read this agreeable and well-produced volume. "My own indebtedness," writes the author, "is chiefly to Prof. Eddington's 'Mathematical Theory of Relativity.' It is easily the best exposition I have read, and I have adhered to it almost slavishly in the following pages." It will be gathered that the treatment is not wholly original, but the book is not a superfluous paraphrase of Eddington's work.

The Geology of the Netherlands East Indies: Lectures delivered as Exchange-Professor at the University of Michigan in 1921–1922. By Prof. H. Albert Brouwer. Recorded and prepared by Laurence M. Gould. (University of Michigan Studies, Scientific Series, Vol. 3.) Pp. xii+160+18 plates. (New York: The Macmillan Co., 1925.) 3 dollars.

THE thanks of all students of geology are due to Prof. Brouwer and to the University of Michigan authorities for this very readable and well-illustrated digest of our present knowledge of East Indian geology; the more so because a large proportion of the extensive literature published on the subject during the last few years has appeared in Dutch.

Of especial interest are those chapters dealing with the tectonic and volcanic features of the region, and their bearing on modern theories of Alpine structure. The author explains how the configuration of a large part of the Archipelago—in particular the two festoons of islands which surround the Banda Sea—is a direct expression of mountain-building processes still in operation. The foreland is formed by the Australian continent and the bordering Sunda shelf; the rising festoons are actual geanticlines, and the deep, elongated sea-basins between them true geosynclines; the younger arc (the inner one) is characterised by active volcanicity, which is absent in the older one. If the compressive forces now in operation persist, a continental mountain range of the Alpine type may ultimately develop.

Higher Mathematics: for Students of Engineering and Science. By Frederick G. W. Brown. Pp. xii+488. (London: Macmillan and Co., Ltd., 1926.) 10*s.*

THIS work embodies those branches of pure mathematics required by senior engineering students up to degree standard and it covers the field very adequately. There are chapters on determinants, spherical trigonometry, several chapters on differentiation and integration and ordinary differential equations up to simultaneous systems, plane curves and three dimensional geometry. For an attempt to return from the monograph to the 'comprehensive' type of book it is eminently successful, and the numerous examples are well chosen with the correct practical bias. The theoretical parts are weaker in presentation than the practical portion, but not sufficient to vitiate a really useful book.

Wolfram: Fortschritte in der Herstellung und Anwendung in den letzten Jahren. Von Dr. Hans Alterthum. (Sammlung Vieweg, Heft 77.) Pp. viii+111. (Braunschweig: Friedr. Vieweg und Sohn A.-G., 1925.) 4·50 gold marks.

THIS useful monograph contains an account of the newer researches on tungsten, its alloys and more important compounds, made since 1910, and is not a complete account of the subject. The localities of the occurrence of tungsten ores, the preparation of tungsten and the physical properties of the metal, together with analytical information and some account of the compounds, are dealt with. There is no index.

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.*]

Solidification of Helium.

ON June 25 helium was compressed in a narrow brass tube forming communication between two German silver tubes. The brass tube and part of the two German silver tubes were in a liquid helium bath. At a pressure of 130 atmospheres the tube system appeared to be blocked. When the pressure was diminished by 1 or 2 atmospheres the tube system was open. The temperature of this experiment was somewhat uncertain. By diminishing the pressure of the liquid helium bath the same phenomenon was observed at a temperature of about 3·2° K. at 86 atmos., and at a temperature of about 2·2° K. at 50 atmos. From the regularity of the phenomenon it appears that we were observing the solidification curve of helium. This method of observing solidification has indeed already been used by Kamerlingh Onnes and Van Gulik in preliminary measurements on the curve of solidification of hydrogen.

A repetition of the experiment on July 1 confirmed the early observations. At 4·2° K. helium solidified at 140 atmos. The solidification curve was prolonged to 1·1° K., and the helium solidified then at 26 atmos. The exact numerical data will be given elsewhere. The solidification curve bends so that at the lower temperatures it shows a tendency to become parallel to the axis of the temperatures. So far as can be ascertained from these observations, helium is expected not to have a solid-liquid-gas triple point.

Finally, helium was compressed in a glass tube provided with a magnetic stirrer after the pattern of Kuenen. The observations on the solidification of helium were confirmed. The stirrer was seen to stick when the helium solidified. In one experiment part of the substance was liquid and part solid. One could hammer the solid block with the stirrer that was in the liquid part. A limiting surface between the solid and the liquid could not, however, be seen. Solid helium forms a homogeneous transparent mass, the refractive index of which probably differs extremely little from that of the liquid.

W. H. KEESOM.

University of Leyden.

Supplementary Note on Radiation.

PERMIT me to make a little correction to my letter on page 891 (June 26) about the law of radiation. It is usual to quote Rayleigh's law in the form there given, namely, $8\pi RT\lambda^{-4}$; the $8\pi R$ part is, however, due not to Rayleigh but to Dr. Jeans (see *Phil. Mag.* for July 1905). In Rayleigh's 1900 paper he left the constant undetermined. Afterwards, in NATURE for May 18, 1905, he concluded, from simple gas-theory, that the constant would be $64\pi R$; but Jeans speedily pointed out a source of error, and made the constant $8\pi R$, a correction which Rayleigh at once accepted (see his "Collected Works," vol. 5, p. 253; also p. 248).

It is interesting to note that had the possible modes of vibration been one-dimensional, as in sound, the numerical part would have been 4π; in light the transverse vibrations have two modes open to them. This makes the constant 8π; while if, as in an elastic solid, vibrations had been possible in all three directions of space, the constant would have been 12π (see Jeans's "Report," p. 14). In no case could it be 64π; but that was a slip, due to counting some integers twice over.

Another point in which my letter might be misleading is that the dynamical proof of the continuous-spectrum law of radiation had given no indication that the result would only be true for long waves. It must have been clear by common sense that it did not hold for short waves, but no reason for this was suggested by orthodox dynamics. The serious discrepancy remained a puzzle, until it was solved by the quantum.

In other words, as I express it, neither gas-theory, probability, nor dynamics was competent to express fully the interaction between matter and ether. An expression obtained by attending to continuous equi partition of energy in matter alone, was bound to be incomplete; while if the doctrine of continuous equipartition was extended to the ether, with its apparently unlimited degrees of freedom, the result was impossible. Indeed, thirty years previously, Maxwell had emphasised this outstanding difficulty of molecular theory, in his lecture on the "Molecular Constitution of Bodies," reported in NATURE, vol. 11, pp. 375-6 (or "Scientific Papers," vol. 2, pp. 433-438), and had decided that whatever the constitution of the ether might be it could not be molecular. Discontinuous partition, as represented by the quantum, enabled the true radiation law to be obtained; and the puzzle was thereby shifted to an explanation of the quantum itself—a problem which can scarcely be solved until we possess more knowledge about the intimate structure of the ether.

OLIVER LODGE.

Prof. Miller's Ether Drift Experiments.

THROUGH the courtesy of Prof. Miller I have been made acquainted with the results of his February series of observations made on Mt. Wilson, to be published in the *Proc. Nat. Acad. Sci.*, Washington. I am sorry to say that my opinion concerning the significance of the observed displacements disagrees with his so completely that I cannot attribute the effect to any cosmic cause.

The calculations of Prof. Miller and his collaborators lead to the conclusion that an ether drift directed towards a point in the constellation Draco (R.A. 17 h., Decl. +68°) would agree best with the observed effects. The drift is assumed to be caused by a motion of the solar system towards the given direction with a velocity of approximately 200 km./sec. A partial drag of the ether is supposed to reduce this velocity to 10 km./sec. at the surface of the earth, thereby annulling the influence of the orbital motion.

My objections against these assumptions are laid down in a paper published recently in the *Zeitschrift für Physik* (vol. 35, p. 723, 1926). The theoretical curves of the line displacements as plotted against the azimuth of the apparatus are given there for different directions of the ether drift. A comparison with the mean value of Prof. Miller's observations shows systematic deviations as large as the full amount of the effect occurring at certain hours of the day. The asserted good agreement between the assumed ether drift and the observations is due to the fact that Prof. Miller has arbitrarily displaced the theoretical curves, giving the azimuth of drift as a function of sidereal time to match the empirical curves. This procedure may be justified in all cases where only the *shape* of the curves is essential. In the present case, however, the absolute values of the curves play a fundamental rôle.

As Prof. Miller rightly remarks, the projection of a

fixed direction in space on the horizontal plane ought to move equally to the east and to the west during a sidereal day. What actually happens is the occurrence of an effect pointing towards the north-west quadrant of the compass in about ninety-five per cent. of all observations. This fact seems to be fatal to the assumption of an ether drift of constant direction towards a certain point of the heavens. If the effect were really genuine it would prove the existence of a north-west drift of the ether accompanying the earth's rotation. The velocity of the drift would be at least 10 km./sec., whereas the velocity of the daily motion of a point of the equator is only about five per cent. of this amount. The advocates of the ether will find it difficult to account for a whirling motion of the ether round the earth with a velocity surpassing that of the earth's rotational motion about twenty times.

Apart from the systematic deviations, there are large irregular discrepancies in the observations. The mean value of the ether velocity at a certain hour of the sidereal day taken from twenty single observations differs sometimes by more than 100 per cent. from the total average for the same hour taken from all observations of a given epoch.

It appears that on account of the extreme difficulties of the measurements, which were vividly described in Prof. Miller's presidential address before the Kansas Meeting of the American Physical Society, the results of the Michelson experiments are less trustworthy and less stringent than they have been supposed to be. The Trouton Noble experiment offers considerably less difficulty, and its negative result may be regarded as more convincing. Dr. R. Tomaschek, of the University of Heidelberg, has repeated this experiment at an altitude of 11,400 ft. at the Jungfraujoch, Switzerland (*Ann. d. Phys.*, vol. 78, p. 743, 1926). The observed effects did not exceed the errors of observation, and it was concluded that there is no relative velocity of the ether greater than 3 km./sec. at the given altitude.

This result gives rise to doubts concerning the significance of the interference shifts observed at Mt. Wilson. The doubts are augmented by the great irregularity of the measured shifts and by the predominance of the north-western direction in the diurnal variation of the effect, which is inconsistent with the assumption of an ether drift of constant 'absolute' direction.

My conclusion is, therefore, that the effect must not be attributed to any cosmic cause at all, but may be due to local disturbances.

HANS THIRRING.
Institut für theoretische Physik,
Universität, Wien,
June 19.

The Molecular Spectrum of Carbon Dioxide.

THE value of the specific heat of carbon dioxide indicates a triangular molecule. Bjerrum (*Deutsch. Phys. Ges.*, 16, 737, 1914) has made a study of this molecule and has decided that the atomic nuclei lie at the corners of an isosceles triangle the apex angle of which is either 145° or 40°·6. Dennison (*Phil. Mag.* (7), 1, 195, 1926) decides in favour of the former angle. Such a model, according to these authors, should be characterised by three fundamental vibrational frequencies. Each tries to associate the three well-known bands of absorption at 14·66μ, 4·25μ and 2·73μ with these predicted frequencies. The model does not anticipate a fourth weak band which I found at 2·02μ (*Phys. Rev.*, 26, 469, 1925), especially since this is not harmonic with any of the other three.

Dennison associates the 4·25μ band with a motion of the carbon nucleus perpendicular to the bisector of the apex angle, and the other two bands with motions of the oxygen nuclei along the line joining them, the carbon nucleus moving along the bisecting line in such a way as to keep the same molecular configuration. In attempting to identify the observed relative intensities of these three bands with his predicted amounts, he meets with success in the case of the two longer wave-lengths but fails in the case of the third one. For whereas this band should be only 1/180th so intense as either of the other two, it actually is found to have 1/4th their intensity.

A new explanation for the presence of the 2·73μ band as well as of the weaker 2·02μ band has been sought on the basis of combinations of the frequencies of the strongest two bands. Table I. shows that the frequencies of the two weaker bands are approximately equal to $\nu_a' + 2\nu_a$ and $\nu_a' + 4\nu_a$ respectively, where ν_a' and ν_a are the frequencies of the 4·25μ and 14·66μ bands.

TABLE I.

ABSORPTION BANDS OF CARBON DIOXIDE.

λ in μ.	ν in mm.$^{-1}$.	Designation.	Calc. ν.	Diff. Per cent.
14·66	68·9	ν_a		
4·25	235·5	ν_a'		
2·73	366·3	$\nu_a' + 2\nu_a$	373·3	1·9
2·02	495·0	$\nu_a' + 4\nu_a$	511·1	3·2

Emission bands corresponding to each of the carbon dioxide absorption bands, including the newly observed weak one at 2·02μ, have been found in the spectrum of the Bunsen flame. Table II. shows the values of these bands, as well as the agreement of the frequencies of the weakest two with values calculated on the basis of combinations similar to those of Table I.

TABLE II.

EMISSION BANDS OF CARBON DIOXIDE.

λ in μ.	ν in mm.$^{-1}$.	Designation.	Calc. ν.	Diff. Per cent.
14·1	70·8	ν_e		
4·4	227·0	ν_e'		
2·76	362·0	$\nu_e' + 2\nu_e$	368·6	1·8
1·99	502·0	$\nu_e' + 4\nu_e$	510·2	1·6

It will be noticed that in every case the calculated combination frequencies are somewhat larger than the observed values. This should be anticipated if we are to associate the terms $2\nu_a$, $4\nu_a$, etc., with approximate harmonic vibrations of some portion of the molecule; for the so-called harmonic vibrations arise from causes which also produce deviations from true overtone relationships, namely, the non-linearity of the force and the finite amplitudes of motion of the nuclei. Thus in the case of hydrogen chloride the first harmonic absorption frequency differs by 1·7 per cent. from a true multiple relationship (Brinsmade and Kemble, *Proc. Nat. Acad. Sci.*, 3, 420, 1917), while extrapolation of the frequencies which I have observed to be characteristic of the C-H bond in all organic substances (*Phys. Rev.*, 27, 298, 1926) indicates a corresponding deviation of 1·85 per cent.

Comparison of the above data shows an increase in frequency in the case of the longest wave-length band in passing from absorption to emission, while an opposite change characterises the 4·25μ band.

This in itself suggests separate origins of the two frequencies within the molecule. Furthermore, it suggests a strengthening of one type of bond and a weakening of the other type when the molecule is subjected to the greater thermal agitation in the flame. This is indicative of a slight change in the molecular configuration.

Further support of the combination theory proposed above is the gradual predomination of the lowest characteristic vibration frequency in the combination bands. This is shown in the approach toward equality in the 2·73μ, 2·76μ bands, and the greater frequency value of the emission band in the case of the 2·02μ, 1·99μ band.

JOSEPH W. ELLIS.
University of California, Southern Branch,
Los Angeles, California.

Higher Order X-ray Reflections from Fatty Acids.

As is known from recent researches, especially in the Davy Faraday Laboratory, X-ray reflection from fatty acids shows the existence of a long spacing, which increases proportionally to the number of carbon atoms in the molecule. Using fatty acid crystals, we have succeeded in observing reflections up to a very high order. We were able to verify the work of Müller, Shearer and others; on the other hand, some new facts were brought to light.

Flaky crystals several millimetres square (the long spacing of which is normal to their surface), obtained by crystallising from acetone, were mounted on the calcite crystal of the X-ray spectrograph; lines due to the latter crystal served as reference lines. Iron-, copper-, and zinc-radiation was used.

As had been found by Müller and Shearer, the 1st, 3rd, 5th . . . orders of reflection from the long spacings are much stronger than the 2nd, 4th, . . . orders. Shearer has shown that this feature may easily be understood by assuming a simple model for the scattering power [1] of the fatty acid molecule. Our photographs show some new complications for the higher orders, as may be seen from the accompanying diagram (Fig. 1). In the upper portion the observed intensities in the case of palmitic acid (C_{16}) are given. These were estimated by eye, much help for a correct estimation being afforded by the fact that $K\alpha$ and $K\beta$ lines appeared at the same time on the plates; the intensity of the $K\beta_1$ is known to be about 25 per cent. that of the $K\alpha_1$ line.

As may be seen from Fig. 1, in the neighbourhood of the 9th order, even and odd orders are about equally intense, whereas at the 16th order the even orders are by far the strongest (the 16th order is about as intense as the 5th).

This intensity-distribution may be accounted for in its main features by a little more detailed model for the scattering power of the molecule [2] than that used by Shearer. Such a model is given in the right-hand part of the figure. As in Shearer's model, two molecules are placed end to end in opposite directions. At one end of the molecule a deficit of scattering matter (CH_3 group) is found; at the other end a surplus (COOH group). Calculations based on this model give for the intensity of the rth order:

$$I_r = \left[\frac{\sin\left(\frac{r\pi}{12}\right)}{r}\right]^2 \text{ when } r \text{ is odd,}$$

$$I_r = \left[\frac{\sin\left(\frac{r\pi}{12}\right) - \sin\left(\frac{r\pi}{24}\right)}{r}\right]^2 \text{ when } r \text{ is even.}$$

These calculated intensities are given in the lower portion of Fig. 1. Bearing in mind that the assumed model is far too simple to express the real state of things, and that, in addition, no correction was applied to the observed intensities, the agreement between calculated and observed values must be called very satisfactory.

Similar results were obtained with lauric (C_{12}) and stearic (C_{18}) acids. In the first case a maximum of intensity for the even orders occurs at the 12-14th order; in the second case, at the 18-20th. In these cases the observed intensities may be accounted for by similar models for the molecules with the same dimensions of COOH and CH_3 group.

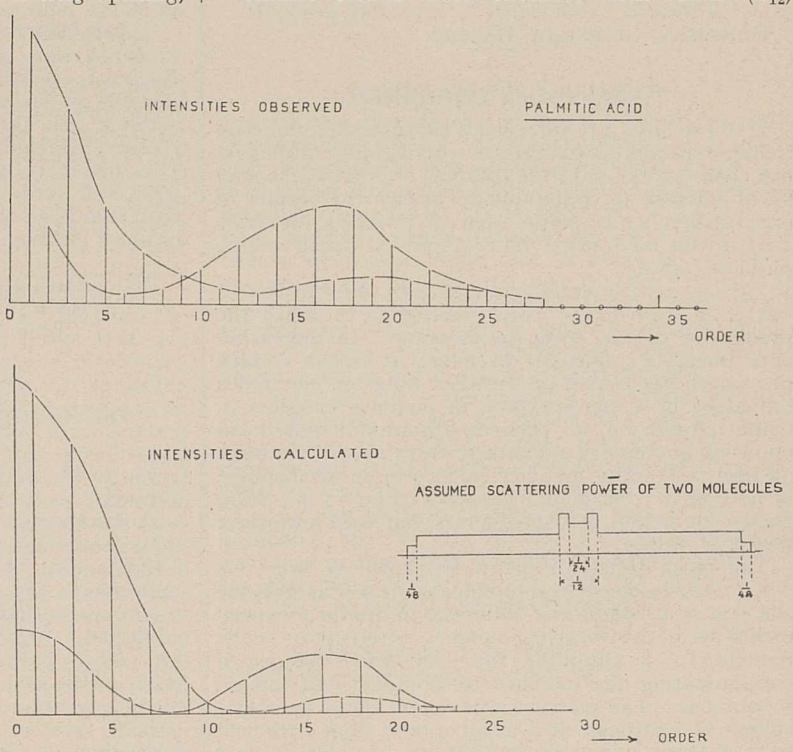

FIG. 1.

A very remarkable fact has been revealed in the case of palmitic and lauric acids. The 34th order of palmitic acid (see Fig. 1) appeared distinctly in four hours on our photographs, whereas other orders higher than the 28th could not be detected even with exposures varying from six to eight hours (such orders sought for but not observed are indicated in the figure by small circles). In the same way the 26th order of lauric acid was clearly visible, no other orders higher than the 21st being detectable. In the case of stearic acid, our crystals were

[1] In this case the scattering power may be assumed proportional to the number of electrons belonging to the different atoms in the molecule.

[2] Strictly speaking, the distribution of scattering matter in planes normal to the long spacing governs the intensities of the different orders, but in this and similar cases this distribution is intimately related to the structure of the molecule; most probably the molecules are inclined at a definite angle to these planes.

unfortunately not good enough to go on to the corresponding (38th) order.

We are inclined to conclude that this singularity of the 34th order of palmitic and 26th of lauric acids depends upon the fact that the scattering matter is not uniformly distributed along the chain of the molecule, but contains a periodicity due to the successive CH_2 groups. The following facts seem to support this view. For twice the long spacing of palmitic acid we found 71·20 Å.U., and in the case of lauric acid, 54·45 Å.U. This means an increase per single CH_2 group of 1·045 Å.U. If we may assume this to be the mean distance of successive CH_2 groups, the double molecule of palmitic acid would be to a very high approximation 34 times this distance, and that of lauric acid 26 times.

The investigations are being continued with other chemical compounds.

Our samples of fatty acids were furnished by the kindness of Dr. Treub, chemist at the Kon. Stearinekaarsenfabrieken at Gouda.

J. A. PRINS.
D. COSTER.

Physical Laboratory,
University, Groningen, Holland.

Transmutation Experiments.

SINCE so large a proportion of the discussion relating to the reported transmutation of mercury into gold has been carried on in the columns of NATURE, it may be of interest to communicate briefly the results of experiments which have been in progress for some time in this laboratory, fuller details of which will be published shortly.

Various experimental arrangements were employed, but in no case has it been possible to establish the production of gold from the mercury. In the earlier experiments a condensed discharge, at a peak voltage of 15,000, was passed (*a*) between tungsten electrodes immersed in a fine emulsion of mercury droplets in white paraffin oil, (*b*) between aluminium rods in an emulsion of mercury in distilled water, and (*c*) between an iron pole and a mercury surface in an atmosphere of hydrogen. Secondary currents up to 75 ma. were passed for as long as twelve hours, but with uniformly negative results.

The most decisive experiment, however, was one which was designed to reproduce as nearly as possible the electrical conditions obtaining in Miethe's experiments with the rotating mercury interrupter, while reducing to a minimum the very grave danger of contaminating the mercury by contact with foreign substances. The mercury was sealed up in an atmosphere of hydrogen in a small quartz tube attached to a shaking machine, so that an arc was formed between pure mercury poles and drawn out to extinction six or eight times per second. A 30-ampere arc at 100 volts was run for 144 hours, followed by an 18-ampere arc at 240 volts for an equal period. During the last 24 hours of this run the tube was made to function as the interrupter for an induction coil, the secondary of which maintained a condensed spark discharge in air. Only 18 gm. of mercury was employed, and this remained perfectly bright and uncontaminated to the last. It was dissolved up at once in nitric acid, without being subjected to distillation, and a direct simultaneous determination proved that 10^{-8} gm. of gold could have been detected with certainty under the conditions of the experiment. No trace of gold was found.

The most conservative calculation based on the results of Miethe (*Zeitschrift f. anorg. Ch.*, **150**, 350, 1926) leads to an expected yield of 0·11 mgm. of gold, or at least 10^4 times the quantity which could not have escaped detection had it been present. Since the electrical conditions were identical in all essential respects with those in Miethe's experiments, it seems necessary to conclude, with Haber (*Naturwissenschaften*, May 7, 1926; NATURE, May 29, 1926), that Miethe's gold was derived from the materials of his electrodes and his vessels.

The mercury used in these experiments had been twice distilled, below 200° C., at the rate of about 100 gm. per hour, in mercury stills of quite ordinary design, and in no single instance could any trace of gold be recovered from the distilled mercury. The writer shares Miethe's opinion that the contrary results of other investigators have been due to mechanical carrying over of the amalgam, rather than to a true distillation of the gold.

An attempt to prepare indium from tin, by a similar method, also failed, though the spectroscopic method of detection was so delicate that great difficulty was experienced in obtaining indium-free tin for the experiments. A further attempt to produce scandium from titanium by electronic bombardment in an X-ray bulb proved equally unsuccessful.

Experiments are in progress upon the reported transmutation of lead into thallium and mercury. Obviously, no artificial production of such a common element as mercury can be regarded as established without the greatest rigour of proof that every possible source of contamination has been eliminated. The difficulty of completely excluding mercury has been well shown by its frequent appearance in the spectrum from the tin tubes, in which it was hoped to produce indium.

MILAN W. GARRETT.

Clarendon Laboratory,
Oxford,
June 25.

The New Element of Atomic Number 61 : Illinium.

IN their interesting note on the discovery of illinium (NATURE, June 5, p. 792) upon which the authors, Messrs. Harris, Yntema, and Prof. Hopkins, may be congratulated, I find the statement that "there were no theoretical grounds for supposing that eka-neodymium [sic!] might exist until Moseley's rule showed that element number 61 was still to be identified." Having devoted almost all my scientific life—since 1877—to the theoretical and practical study of the elements of the rare earths, and especially to the question regarding their position in Mendeléeff's periodic system (the object was not very popular forty-eight years ago!), one of the results of which was the decomposition of the old didymium in 1882, I arrived at the conviction that the gap between the neodymium and samarium was abnormally large. In my paper read before the Bohemian Academy and the Russian Association of Scientists in St. Petersburg in 1902, I came to the conclusion—not reached by any chemist before—that the following seven elements, possessing now the atomic numbers 43, 61, 72, 75, 85, 87, and 89, remained to be discovered. As regards element No. 61, the difference between the atomic weights of Sm − Nd = 6·1, and it is greater than that between any other two neighbouring elements. It is remarkable that it is of the same order as that between the atomic weights of Mo − Ru = 5·7, between which stands ekamanganese, and of Os − W = 6·9, between which stands dwimanganese, recently discovered in our laboratory by Heyrovský and Dolejšek.

Personal knowledge of the chemistry of neodymium —the spectrum (absorption) I thought too complicated—and samarium brought me to the conclusion that also between those two elements an unknown element was missing, but all investigation by old methods was fruitless. Another reason may also be of interest. On arranging the true hydrides (in which the hydrogen is negative towards the positive metal) of the elements of the 8th series of the periodic system according to the order of their atomic weights, we find the following remarkable regularity of the composition of those peculiar compounds :

CsH_1, BaH_2, LaH_3, CH_4, PrH_3, NdH_2, (XH_1), SmH_0.

As samarium does not combine with hydrogen (Muthmann) there must exist between neodymium and samarium an unknown element which forms the hydride XH—*and this element is illinium*. My speculation has not proved futile.

BOHUSLAV BRAUNER.

Bohemian University,
Prague, June 12.

Identity of *Herpetomonas papatasii* and *Leishmania tropica*.

THREE successful experiments have been recorded by us in which cutaneous leishmaniasis was transmitted to man by inoculation of *Herpetomonas papatasii* from naturally infected sandflies (*Phlebotomus papatasii* ♀ ♀) (*Annals of Trop. Med. and Parasitol.*, vol. 20, No. 2). Noguchi ("Action of Certain Biological Chemical and Physical Agents upon Cultures of Leishmania ; Some Observations on Plant and Insect Herpetomonads." International Conference on Health Problems in Tropical America, 1924) and Kligler ("The Cultural and Serological Relationship of Leishmania." *Transact. Roy. Soc. Trop. Med. and Hyg.*, vol. 19, Nos. 5 and 6, 1926) have introduced methods of preparing immune sera and distinguishing *Leishmania tropica*, *L. donovani*, and *L. braziliense* by agglutination. Agglutination and cross agglutination experiments with cultures from the three experimental lesions and three strains from naturally acquired lesions (two from Palestine and one from Baghdad) definitely proved the identity of the organisms from the experimental lesions with *Leishmania tropica*. *Herpetomonas papatasii* is, therefore, a synonym of *Leishmania tropica*, and the fact that *Phlebotomus papatasii* is a natural transmitter of cutaneous leishmaniasis is completely established, since in addition to the evidence of experimental transmission the Herpetomonas naturally occurring in the above insect is shown to be biologically identical with *Leishmania tropica*.

We hope to publish shortly complete details of our experiments elsewhere.

S. ADLER.
O. THEODOR.

Microbiological Institute,
Hebrew University,
Jerusalem.

Pernicious Grafting.

THE Madeira agriculturist will be glad of any enlightenment on a devitalising influence frequently experienced in grafting a vigorous wild peach or nectarine seedling with a scion from a cultivated example. The wild seedling germinates from any chance seedstone thrown upon our terraces and develops rapidly into a sturdy tree, almost evergreen in character, crowded in the late autumn with a wealth of fascinating flower before the deciduous annual foliage has left the branches bare, and yielding from early spring onwards an overwhelming crop of disappointing fruit.

If such a stock is cut across and grafted from a more worthy example in February, organic union is perfectly established and the new grafts speedily develop into sturdy ligneous growth which, by November, exhibits a promise of the vigorous output of leaf and flower customary in the wild seedling. But something now happens, and the tree, paralysed or devitalised, passes through the winter and spring months without a single leaf- or flower-bud breaking forth into activity.

Vitality is entirely suspended, and the tree is apparently poisoned by the introduction of an incompatible sap, although a modified life or mere existence may endure indefinitely. The removal of the intrusive grafts is unavailing, for the condition is all-pervading and not one of local obstruction.

Madeira is scarcely four days distant from the London markets, and it is of economic and commercial importance to remove any impediment to the almost perennial output of our sun-ripened produce.

MICHAEL GRABHAM.

Madeira, June 24.

Organo-Metallic Compounds.

AN X-ray investigation of the structure of the series of compounds carbon-, silicon-, germanium-, tin-, and lead-tetraphenyls, now almost completed, appears to indicate an interesting field of research in the organo-metallic compounds. It is proposed to extend the work to other series of these compounds so that after a time a systematic study may be made of the effects of varying (i.) the element, and (ii.) the groups. In order that this may be attempted, the writer appeals to chemists for the loan of small quantities of any related organo-metallic compounds which may be stable solids in air at ordinary temperatures.

To give an idea of the quantity of material sufficient for this work, it may be stated that the crystal of germanium tetraphenyl kindly lent by Prof. G. T. Morgan and found to give satisfactory results measured only 1·5 mm. by $[0{\cdot}065 \text{ mm.}]^2$, whilst from 0·15 gm. of powdered tin tetraphenyl kindly lent by Mr. A. E. Goddard, Mr. W. B. Saville, who is co-operating with me in this work, was able to grow a number of crystals suitable for use on both the photographic and the ionisation X-ray spectrometers.

WM. H. GEORGE.

Davy Faraday Laboratory,
20 Albemarle Street, London, W.1.

Blood Reactions and Sex.

THE method elaborated by Manoilov for distinguishing the sexes has been used by us in the case of the fowl. Male can certainly be distinguished from female by this test. Seven birds which previously functioned as hens but now, having undergone complete sex-reversal, are fecund and potent cocks, all exhibit the female reaction indubitably. This being so, this test may be expected to provide valuable corroborative evidence concerning the genetic sex of certain kinds of sexually abnormal individuals.

The reaction in the case of blood from a fowl from which the gonadic tissue has been removed is, in our hands, not yet sufficiently definite.

F. A. E. CREW.

Animal Breeding Research Dept.,
University of Edinburgh,
July 5.

X-Rays and Living Matter.[1]

By Prof. J. A. CROWTHER, University of Reading.

THE possible importance of X-rays in the medical world was recognised so clearly by their discoverer, Röntgen, that the first communication on the subject was made by him to a medical society, and was published to the world in a medical journal. Nor were medical men slow to appreciate the potency of the weapon which had thus been placed in their hands. The medical profession, be it spoken to its praise, has been unremitting in its search for new weapons in the fight against disease. Dr. Gilbert, himself no mean physician, and author of the first treatise on magnetism, records, with perhaps undue scorn, how, in the days when magnetism was the latest scientific marvel, patients were dosed with decoctions of lodestone as a possible panacea for all ills. It was not likely that so startling a discovery as X-rays would be overlooked, and we find medical men among the pioneers of X-ray work in nearly all countries. Further, the economically effective demand of medical radiology for more power, and still more power, has persuaded engineers and manufacturers to produce the modern high-power X-ray plant which has made possible the recent advances in the subject.

It was discovered early, but unhappily not early enough, that whatever healing power the radiation might possess, its destructive power on human tissue was indubitable and great. Few of the pioneers of radiography and radiotherapy escaped the painful and intractable X-ray burn, which arises from too prolonged an exposure to the radiation, and not a few have died as a result of the injuries thus received. Their labours have not been fruitless, and X-ray treatment is now a standard part of the work of any properly equipped hospital. At the same time one can detect to-day a certain undercurrent of dissatisfaction among radiologists. The rays have not yet fulfilled all their expectations. In particular, in some grave diseases where remarkable cures have been effected by X-ray treatment, a repetition of the same treatment in other apparently similar cases does not invariably produce the hoped-for result. There are undiscovered factors remaining to be elucidated. We need to ask how X-rays act on living matter, and in particular upon the living cell from which all living matter is built. The biologist, the physicist, and the chemist must be called in to assist, and the investigations must take in a wider sweep, before these problems can ultimately be solved. In science, as in other walks of life, it sometimes happens that the longest way round is the shortest way home.

It must not be supposed that so promising a field of research has been hitherto left uncultivated. There is, on the contrary, an overwhelming accumulation of observations and experiments. The results of different observers are, however, so conflicting that most of the evidence cancels out and leaves only a small residuum which can be said to be known with any certainty. This is scarcely surprising when we consider the conditions under which much of the work has had to be done. It is only within quite recent years that apparatus has been designed which makes it possible to repeat a given exposure with even approximate certainty, even with the same apparatus. It is not possible, even now, to give identical exposures if the apparatus is changed; if, for example, a high-tension transformer is substituted for an induction coil, or a Coolidge tube for a gas tube. Each type of apparatus for producing X-rays, one might almost say each individual set, has its own peculiarities, which are reflected in the quality and quantity of the radiation it produces. Our present state of knowledge does not allow us to assume that any of these variations have a negligible effect on the results.

Nor is there, at the present moment, any standardised or completely satisfactory method of recording these varied exposures. The properties of a given X-radiation are determined, physically, by its wave-length or frequency and its intensity. The radiation from an X-ray tube is, however, not monochromatic. It consists of a band of radiation stretching over a considerable range of wave-lengths. In optical terms, our X-ray tube gives us a continuous spectrum, which, moreover, may be crossed by intensely bright lines due to the characteristic radiation of the target from which the rays come. The band of maximum intensity moves towards the short wave-length end of the spectrum as the potential on the tube is increased, but the radiation is always mixed. In fact, for a given current, we shall get a larger absolute output of radiation of long wave-length from a tube working at high potential than from one at low potential. The distribution of energy in this complex spectrum depends on the wave-form of the high-tension apparatus used to supply the X-ray tube, and on the tube itself. If, as seems quite possible (there is ample experimental evidence both for and against the supposition), the biological effect is a function of the wave-length, it becomes a matter of considerable importance to determine not only the extreme wave-lengths but also the distribution of energy between the different wave-lengths in the radiation used. The discoveries of Prof. Laue, and their ingenious applications by Sir Wm. Bragg, have rendered this possible, but in very few researches so far conducted on the action of X-rays on living matter has any attention been paid to this important factor.

The measurement of the intensity of the radiation is a still more difficult problem, and one which cannot yet be said to have been solved by the physicist. The ideal method would be to measure the energy in the beam by absorbing it completely in some heavy metal, such as lead, and measuring the heat produced. Unfortunately, the actual energy even in a powerful beam of rays is so minute that, although it has been detected, it would strain the resources of a well-equipped physical laboratory to measure it with any accuracy. It is necessary to fall back upon some secondary property of the rays. The only secondary property which is capable of being measured with the necessary accuracy is that of producing ionisation in any gas through which it passes. Gas through which X-rays are passing becomes feebly conducting to electricity

[1] Substance of a course of two lectures delivered by the author at the Royal Institution on January 19 and 26.

and the current which can be passed across the gas is a measure of the ionisation, and thus, indirectly, of the intensity of the radiation. Prof. Friedrich has proposed that the amount of X-radiation which will allow a charge of one electrostatic unit to pass across one cubic centimetre of air shall be taken as the unit quantity of X-radiation. This proposal has met with some opposition, but personally I do not see the possibility of finding a better unit, at any rate in the immediate future. At least it may be affirmed that until experimenters can agree upon some method of measuring their quantities, progress is not likely to be rapid.

If any apology should appear to be needed for devoting so large a portion of our space to the question of measurement, it is certainly provided, not merely by the large mass of painstaking observations which have been rendered almost nugatory for want of it, but also by the records of recent work in the subject. Everything, in fact, seems to indicate that the biological effect of the rays may vary in a perfectly astounding manner with quite trifling variations in the magnitude of the exposure and the wave-length of the radiation. Only within the last few months a paper has come through from Australia, in which the author, Dr. Moppett, claims to have demonstrated a selective effect of the radiation of surprising sharpness. Dr. Moppett spread out his beam of X-rays into a spectrum, by means of a Bragg spectrometer, and exposed one of the important membranes of an ordinary chicken embryo in turn in various parts of the spectrum. He found that at certain definite positions in the spectrum, that is to say for certain definite wave-lengths of the radiation, the cells in the membrane were rapidly killed by the action of the rays, while much longer exposures to neighbouring wave-lengths produced no effect. The effective radiations had wave-lengths of 0·11, 0·53, and 0·79 Ångström units. Wave-lengths differing by only a few per cent. from these values were quite inoperative.

The paper, it must be confessed, is sadly lacking in the details which a physicist requires to assess its accuracy, and in many particulars it is by no means clear. One would certainly not have expected to obtain a selective effect with radiation of so short a wave-length as 0·11 Å.U., and if this result is verified we may have to revise some of our physical ideas as to the absorption of X-rays by matter. It is desirable that Dr. Moppett's work should be repeated. If, however, for the moment we accept these results, it is not difficult to point the moral. The wave-length 0·11 Å.U. is somewhere near the limit of the spectrum for a hard X-ray tube. It requires for its excitation a voltage across the tube of about 120,000 volts. Suppose the experimenter to be working his tube somewhere about this voltage. A slight rise in the voltage will produce a copious supply of the deadly radiation. On the other hand, if the voltage falls by but a small amount this radiation may be absent altogether. A trifling change in the supply voltage, to which few of us would, in practice, pay any attention, may thus completely alter the nature of the results obtained.

Experiments indicate that the margin in the case of the dosage given is equally narrow. Although the effect of a prolonged exposure to X-rays is invariably lethal, small doses often produce a healthy stimulation. This has been proved, by Prof. Russ among others, in the case of rats. It is also very evident in the case of Protozoa. I have found that an old culture of *Colpidium Colpoda*, for example, may be stimulated to new growth and active division by a suitable dose of radiation. The margin between stimulation and death is a very narrow one. In fact it is possible, by a careful adjustment of the dose, to have as the result of a single exposure individual colpidia, showing every sign of stimulation, swimming about vigorously among the corpses of those which have been killed by the same dose. A slight increase in the dose, say an extra ten per cent., will kill off the whole culture. A decrease of ten per cent. produces only stimulation. It is clear, in this instance at any rate, how narrow is the margin which separates these diametrically opposite effects. In radio-biology—if we may be permitted to coin the word—as in other sciences, exact measurement is the key which unlocks the door of knowledge.

It is no part of the purpose of this article (the attempt would be impossible in any case) to give a résumé of the vast amount of observations made on the action of X-rays on living matter. It is doubtful whether most of them can throw much light on the fundamental problem which underlies them all. In irradiating an animal, or even a tumour growing on an animal, we are dealing with a part of a highly organised and closely interrelated structure, and any effects which are observed may be merely secondary and only indirectly due to the irradiation. So true is this that it applies even to the parasites on the body. Bacteria, for example, are notoriously resistant to the action of the rays when exposed in a pure culture. On the other hand, the same bacteria infecting a wound will often be killed by quite small exposures to the radiation, and such exposures are now frequently used as a means of clearing and healing a wound. The problem, difficult enough in any case, only becomes manageable if reduced to its simplest form, and the simplest form in biology is the individual cell.

We are fortunate in possessing at least a preliminary study of the effect of X-rays on the individual cell. Methods have now been perfected by which it is possible to remove a number of cells from the tissues of a live animal and to cultivate them for long periods in glass vessels, where they continue to thrive and multiply, quite independently of the fate of the animal of which they were once a part. Dr. Strangeways has studied the action of X-rays on these isolated cells, and a preliminary account of his work was communicated a year or so ago to the Royal Society. One of the striking facts which emerges from his work is that it is extremely difficult to destroy a resting cell by the action of the rays. Doses far heavier than could be safely applied to the human skin leave them apparently unaffected. Further observation, however, showed that this absence of effect was only apparent. The cells had been very vitally affected, but the effects of the rays only became visible when the cells began to divide.

The first effect of the rays, produced by quite short exposures, was to lessen very materially the number of cells passing through the process of cell division, or mitosis. Dr. Strangeways records that an exposure of only 5 of Prof. Friedrich's units produces an

appreciable diminution in the number of cells passing into mitosis. With a dose of 10 units the number was still less. After 15 units only a few cells in mitosis were visible, but the phenomenon was seen occasionally until the exposure reached as much as 85 units. Thus while a small dose of X-rays is sufficient to prevent the majority of the cells from dividing, a much larger dose is required before the whole of the cells are affected.

Dr. Strangeways has not yet provided us with a numerical estimate of this effect, but we hope that he and his collaborators may be able to do so before long. In the meantime, if we attempt to express his descriptions graphically, the curve which we shall have to draw relating the number of cells in mitosis with the exposure to the rays will be one which, plunging rapidly downwards at first, approaches zero asymptotically for prolonged exposures; it will, in fact, resemble closely an exponential curve. Now a curve of this type suggests strongly that the effect we are considering is a probability effect—in other words, that whether a cell will or will not go into mitosis after a given dose of X-rays is a matter of chance, the probability of its not doing so becoming greater as the dose is increased. This variability may, of course, be in the cell. Some may be more susceptible to the action of the rays than others. It is always legitimate, though not very helpful, to invoke the biological factor. I have ventured to suggest the possibility that it has nothing to do with the cell, but lies in the nature of the agent which we are using against the cell, that is, in the X-rays themselves.

An analogy, which is in fact a very close one, may help to make the matter clear. Suppose that we were firing at a swarm of midges with a machine gun. The number we should hit per second would be proportional to the number present in the swarm. At first we should claim a large number of victims, but, as the swarm gradually melted under our fire, the chance of hitting a midge would become smaller and smaller. To hit the last two or three would entail the expenditure of much ammunition and considerable patience. The survivors, however, would not owe their prolonged existence to any biological factor, or to any immunity either inherent or acquired, but simply and solely to their good luck. The number of survivors would, in fact, decrease exponentially as the number of bullets fired into the swarm increased.

Now, as Prof. C. T. R. Wilson's photographs show us very graphically, a beam of X-rays is very much like a swarm of bullets—only a negligible proportion of the atoms in the path of a beam of X-rays are affected in the least by the passage of the beam. It is quite easy to show that if the rays are conveying a dose of one unit per minute, as was the case in Dr. Strangeways' experiments, an individual atom would be effectively hit by the radiation on an average only once in a million years. The probability of a hit increases with the size of the particle, and a tissue cell would receive on an average about 14 hits per second, but as a hit is a matter of pure chance some would clearly receive more and others less than the average. This variation becomes more important as the size of the particles becomes smaller, and some of the important structures in the cell are much smaller than the cell itself.

It is not difficult to calculate what size the structure must have to fit in with the curve which we have constructed from Dr. Strangeways' description, on the assumption that a single hit registered by the rays on this particle suffices to put the cell out of action. Its diameter, assuming it to be spherical, would have to be about 1/2500 m.m. This is of the order of magnitude of the centrosome, a body which is considered by many biologists to play an important part in the process of cell division. With a target of this size, half the cells would be put out of action with an exposure of 12 units, 25 per cent. would survive a dose of 24 units, while 6 per cent. would still be capable of mitosis even if the dose were increased to 48 units. It will be seen how closely these numbers fit the phenomena we have described. It seems possible, to say the least, that the quantum theory must be taken into account in biology as well as in physics, and that a single cell may have a much more direct and painful appreciation of the existence of quanta than is possible to our grosser senses.

The scanty data which we possess on the action of X-rays on living cells indicate that the simple exponential relation which we have suggested is rather exceptional. The curve relating the number of survivors to the dose of X-radiation is generally sigmoid in shape. Practically no effect is produced until the dose exceeds a certain value. After this point is reached the number of cells affected increases rapidly, but there are always a few which survive much larger doses than the average. Curves of this kind are given by Dr. F. C. Wood, as expressing the result of his recent experiments on the effect of X-rays on cancer cells *in vitro*. Theoretically, we get a relation of this kind if we assume that a definite succession of hits is required to produce the result we are aiming at—say, for example, the destruction of the cell. I have given a calculation of the form of the curve on this assumption in a recent paper before the Cambridge Philosophical Society. A very considerable amount of rather tedious work will be necessary before sufficiently experimental results can be obtained to afford a real test of the theory, but the results so far accumulated are distinctly promising.

It need not be emphasised that these attempts to drag the biological action of X-rays into the domain of physics are extremely tentative. It is possible, even probable, that in the ultimate issue we shall find in the living cell something which transcends all physics and chemistry, but this is no legitimate excuse for failing to push our sciences to their extreme limits. Whatever the ultimate result may be, we are sure to find much of interest by the way. The primary effect of the absorption of X-rays by an atom, in fact the only effect of which physicists are aware, is the expulsion of a high-speed electron from the atom. That, it would appear, must be the starting point of any purely physico-chemical theory of the action of X-rays on living matter. What subtle series of changes is thus initiated in the complex chemical compounds which make up the cell is a problem, like that of the song the syrens sang, the answer to which no man knows, but which may not be beyond the wit of man to conceive. Nature, as usual, leaves us guessing. That is precisely why we find her so fascinating.

The Rhynie Crustacean.

By Dr. W. T. CALMAN, F.R.S.

MR. D. J. SCOURFIELD'S memoir "On a new Type of Crustacean from the Old Red Sandstone (Rhynie Chert Bed, Aberdeenshire), *Lepidocaris rhyniensis*, gen. et sp. nov." (*Phil. Trans.* B, 415, 1926), which has already been noticed in NATURE (April 3, 1926, p. 498), is so important a contribution to arthropod morphology that no excuse is needed for directing further attention to some of the problems suggested by it.

In the first place, it should be emphasised that no other fossil crustacean is known with anything approaching the completeness with which Lepidocaris has been described by Mr. Scourfield. The only fossil arthropod, and in fact the only fossil invertebrate, which comes near it in this respect is the well-known *Eurypterus fischeri* as described by Holm. In the second place, in spite of its antiquity, Lepidocaris is far from being a primitive crustacean. In some respects (notably in retaining the biramous swimming antennæ of the nauplius) it is indeed more primitive than the existing Anostraca, but it shares with them many characters that are by no means primitive, such as the simplified mouth-parts, which are much more specialised than those of many Copepods. The development of male claspers, of Anostracan type, from the maxillulæ instead of the antennæ, is a surprising feature, the significance of which remains obscure. It may indicate that Lepidocaris is off the main line of Anostracan descent. It is doubtful also whether the absence of eye-stalks can be regarded as a primitive character.

One of the most difficult problems of crustacean morphology has been the correlation of the biramous type of limb found in so many Crustacea with the 'phyllopod' type seen in the Branchiopoda. Since Ray Lankester, in his classical memoir on Apus, showed that the Branchiopoda (or Phyllopoda) are the most archaic of living Crustacea, it has been generally accepted that the biramous has been derived from the phyllopod type. Lankester argued that the two branches of the biramous limb, the endopod and exopod, were derived from the two distal 'endites' or lobes of the inner edge of the phyllopodium. Huxley had earlier identified the exopod with the 'flabellum' of the Phyllopod and the endopod with the distal part of the stem or 'corm,' and this interpretation has been adopted by others, notably by Dr. Borradaile in a recent paper.[1] Lepidocaris would seem to provide the answer to this question, for while the first three pairs of its trunk appendages are phyllopodia, comparable without much difficulty with those of recent Branchiopoda, the following limbs are biramous; and it is perfectly clear that the exopod of the posterior limbs is equivalent to the flabellum of those in front, the endopod being the distal endite.

Dr. Borradaile inclines to the opinion that, in the

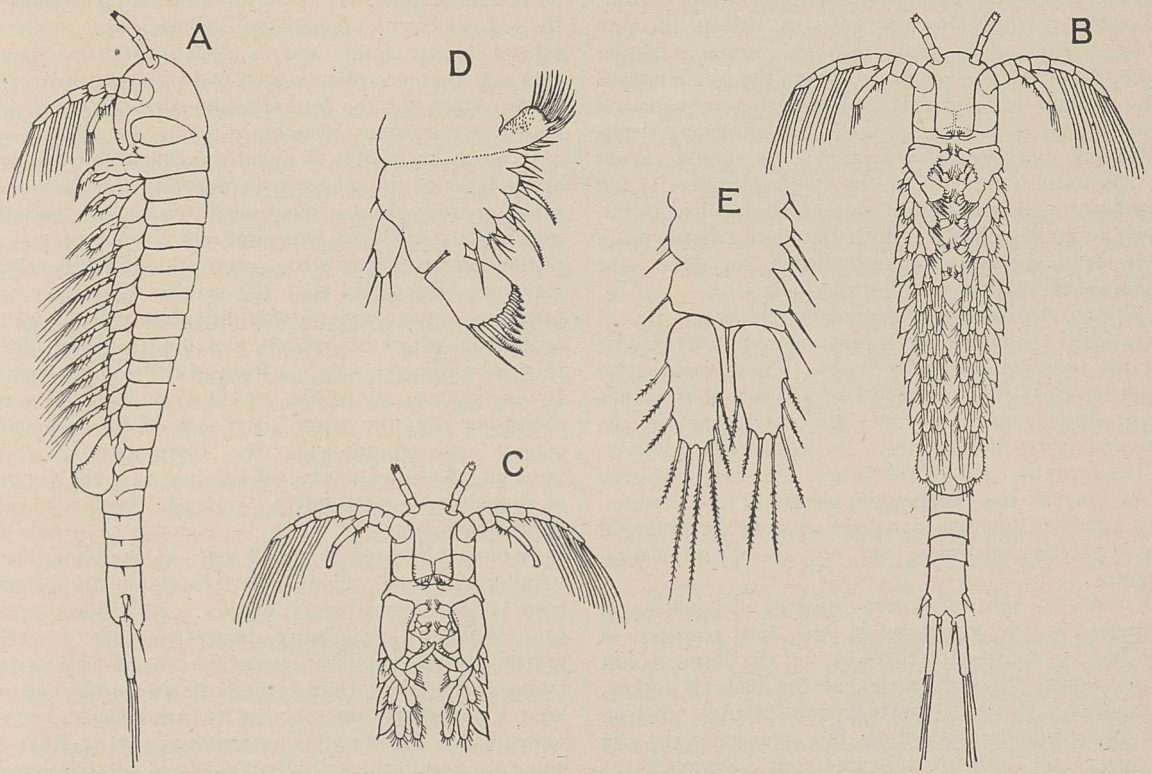

FIG. 1.—Restorations of *Lepidocaris rhyniensis*, Scourfield. A. Female, from the side. B. Female, from below. C. Male, anterior part of body from below. D. One of the first pair of trunk limbs. E. One of the trunk limbs of the posterior (? seventh to eleventh) pairs. Approximate magnification, A, B, and C×27, D×9, E×10. (After Scourfield.)

[1] "Notes upon Crustacean Limbs," *Ann. and Mag. Nat. Hist.* (9), **17**, p. 193, 1926.

evolution of the Crustacea, the biramous form of limb has been arrived at more than once by different modifications of the phyllopod type. In view, however, of the simple biramous form of the limbs in the nauplius larva and in the Trilobites (the close relationship of which to the Crustacea cannot now be doubted), and of the persistency with which the same type emerges in the most diverse groups of Crustacea, it seems more reasonable to assume that it represents the deep-seated plan of symmetry on which all crustacean limbs are built. It is indeed possible that the phyllopod type preceded the biramous and that Lepidocaris preserves the transition from one to the other. This would seem to be the view taken by Mr. Scourfield, who, although he gives us little in the way of speculation, does imply that the biramous hinder limbs of Lepidocaris are derived from the phyllopodous type of those in front. It is, however, a very general rule among Arthropoda that specialisation begins anteriorly and works backwards; we should expect the posterior limbs to be the more primitive; and Lepidocaris gives the impression of having had primitively biramous limbs of which the more anterior pairs have been specialised in adaptation, no doubt, for some special method of collecting food.

A minor problem is presented by the lateral row of large scales (to which the generic name alludes) covering the bases of the trunk limbs. These suggest the small scales at the base of the outer edge of the limbs in Anostraca which are generally interpreted as the proximal exites of the limbs. In Lepidocaris, however, at the posterior end of the series, the scales are seen to be merely the pinched-off pleura of the somites. It is a matter for further inquiry whether the proximal exites of the Anostraca may not also be of pleural origin.

Perhaps the most unexpected feature of Lepidocaris, however, is the structure of the last segment of the body. In many Crustacea, in the larva if not in the adult, the termination of the body is forked. Very often this fork is nothing more than a notch in the hinder edge of the telson, but sometimes the two prongs of the fork are movable rods jointed to the segment, and in a few cases (Notostraca, Cirripedia) they are long, many-jointed filaments. In Lepidocaris we see clearly, for the first time, that these movable appendages are not, as has been generally supposed, homologous with the two branches of the notched telson. In the earliest larva found the telson is notched, and this notch persists in the adult to form what Mr. Scourfield calls the "primary furca." In the later larvæ, however, a pair of rod-like appendages grow out at the sides of the primary furca and become separated by articulation from the body of the telson, forming a "secondary furca" which is evidently the homologue of the articulated furca of Anostraca, Copepoda and Phyllocarida. In still later larvæ a second smaller pair of appendages appear at the sides of the telson in front of the secondary furca. Just above the articulation of each of these two pairs of appendages is set a small spine. The somites immediately in front of the telson bear no appendages, but each has, on either side, a similar spine, and as these spines are traced forwards they are plainly seen to be in series with the spines which tip the lateral scales already mentioned above the insertion of the limbs.

It seems impossible to avoid the conclusion that the appendages of the telson in Lepidocaris and the furcal rami of the groups mentioned above are serially homologous with the true limbs of the anterior part of the body. Now it is the general rule in the development of Arthropoda that the somites and their appendages appear and become differentiated in regular order from before backwards, new somites being added from a 'formative zone' in front of the telsonic region. In Lepidocaris alone do we find evidence of true appendages on the telson itself, *behind* the formative zone; and, emphasising the singularity of their position, the order of their development is the reverse of that of the pretelsonic appendages, the hinder pair appearing first.

It must be borne in mind that, at the time when Lepidocaris lived, the Crustacea had already behind them a long evolutionary history. It is now known from Walcott's remarkable discoveries that, so early as the Middle Cambrian period, a varied crustacean fauna existed and that several of the forms had at least a superficial resemblance to Anostraca. Unless some chance discovery, as fortunate as that at Rhynie, and an investigator with Mr. Scourfield's indefatigable patience and skill, combine to reveal a great deal more than we know at present about the structure of these early forms, speculations on phylogeny must go very cautiously.

Obituary.

Dr. Edward J. Bles.

BY the recent death of Edward J. Bles, zoological science has lost a devoted worker whose qualities of mind and character were of the highest. It is the faith of many of his friends that, but for factors of temperament, and health, he would have become a leader of thought in the subject of his choice. His publications, though of high merit, were relatively few; but his intimates know that they were far from representing all that he accomplished, and are aware of the temperamental restraints but for which he could and would have published much more. He was one of those investigators—deserving sympathy from colleagues with easier standards—who would fain allow publication to wait for perfection, and yet realise even better than others that perfection never arrives. In spite of such inhibitions, or perhaps because of them, his published output is of high value and stamped with the quality of absolute reliability.

For elementary teaching, or, at any rate, for the shackles of departmental teaching and organisation, Bles had some distaste. On the other hand, he was the ideal colleague and one of the most educative influences for the young research worker. He would give his time and ingenuity for days to devise methods for another's work; he was a most sincere and painstaking critic and there never was any one with whom it was more delightful to share the joys of discovery or the fruits of victory. Yet he greatly prized independence, and the freedom to work out his own ideas on his own

lines. Being possessed of sufficient private means, Bles was therefore finally led to avoid all official posts, and for nearly twenty years he worked, first at Iffley, Oxford, and later, until the end, at Cambridge, in private laboratories equipped by himself. This involved, of course, some degree of isolation, and the additional factor of weak health finally led him to become scientifically somewhat of a recluse. In visits from scientific friends, however, he always took the greatest pleasure, and, to the end of his life, those who had the privilege of paying such visits profited always from contact with a truly philosophic mind and a stimulating personality. His wide learning was at the service of all.

Born in 1864, he was the son of A. J. S. Bles of Manchester. When fourteen years old he was sent to a school in Hanover where the teaching of science seems to have been exceptionally good. Family interests led him at the age of eighteen years to start in his father's business at Manchester; but his own interests directed him from the first into scientific company. He joined the Manchester Microscopical Society and became its secretary. Thus arrived the turning-point of his life. He came under the influence of Milnes Marshall, who saw his bent and genius, and for whom Bles then acquired, and ever afterwards retained, great love and admiration. He joined the Owens College, attended Milnes Marshall's classes, and in 1890 became, with his teacher, joint author of papers dealing with the development of amphibia, a subject which for some time remained one of his chief scientific interests. About this time he went to occupy a table at Naples and returned to carry out the duties of junior demonstrator of zoology at the Owens College. From 1892 until 1894 he was Director of the Marine Biological Association's Station at Plymouth. He went up to Cambridge in 1895 and took a research degree in 1898. When Prof. J. Graham Kerr was appointed to the chair of natural history at Glasgow, Bles accompanied him as his assistant and remained at the University until 1907, when he went to live at Iffley, Oxford.

In 1911 Bles removed to Cambridge. Before his last migration his scientific reputation had been made by the publication of important papers; especially by one which appeared in the *Transactions of the Royal Society of Edinburgh* in 1905 on the life-history of *Xenopus Lævis*, and another dealing with the development of certain Anura published in the volume issued by the Cambridge University Press as a memorial to John Samuel Budgett. Of these two papers describing work of fundamental importance, Prof. W. E. Agar writes: "They are very characteristic of Bles' work and scientific attitude. He would take an immense amount of trouble over the smallest detail, lingering over it with a loving care. . . . The plates in these two papers could scarcely be surpassed, either for accuracy of detail or beauty of execution—the result of laborious co-operation between the author and the artist, Mr. A. K. Maxwell. It is worthy of note that these plates contain the first scientific illustrations produced by this artist whose work is now so well known to biologists." The interest of the artist in such work must have been stimulated by his early collaboration with an investigator like Bles, whose own love of accuracy and beauty of execution were so great.

After his Cambridge laboratory was equipped, Bles started to breed various species of rare amphibia, a difficult enterprise in which he had the assistance of his devoted wife. This work was carried out with elaborate care and led to most interesting scientific observations, especially with regard to certain little-studied aspects of metabolism, to the significance of which Bles was keenly alive. The most important work of his Cambridge period had been begun at Oxford. It consisted of an elaborate and highly original study of Arcella by microchemical methods, during which Bles developed a very beautiful technique and obtained results of great importance. Unhappily, the inhibitions to which reference has been made became exaggerated in his latest years, largely because of continued ill-health, and the results of this prolonged research, though known to many, have not yet appeared in print. A paper was practically finished, however, and very fine drawings are available for its illustration. Its publication will be secured in the immediate future under arrangements made in the author's will.

Bles was not merely a scholarly biologist in a very wide sense, he was also a man of fine general culture; music, literature, and the arts all made a vivid appeal to him. He had, moreover, a true sense of values and a very beautiful appreciation of the relative importance of things. His knowledge was of the widest, but so philosophic was the cast of his mind that synthetic thought was essential to him. He endeavoured always to see things as a whole. F. G. HOPKINS.

PROF. V. A. STEKLOV.

PROF. VLADIMIR ANDREJEVICH STEKLOV, member and vice-president of the Russian Academy of Sciences, an eminent and well-known mathematician, died at Ialta (Crimea) on May 30.

Steklov was born in 1863 in the province of Nishni-Novgorod as the son of a country priest. He attended a classical school at Nishni-Novgorod and afterwards entered the University of Moscow to study medicine, but he soon left Moscow and went to Kharkov to study mathematics under Liapunov and became his most gifted pupil and lifelong friend. He graduated at Kharkov, took the usual degrees of magister and doctor of mathematics, and was appointed professor at this University. His first work, "On the Motion of a Rigid Body in a Fluid," was published in Russian in the *Memoirs of the Mathematical Society of Kharkov*. In this paper he found several new 'integrable' cases of this problem. His thesis for his doctorate was "On the Principal Problems of Mathematical Physics." Such problems formed the basis of his subsequent numerous investigations, extending over a period of nearly thirty years. In these investigations he established his "théorème de fermeture," relating to the development of arbitrary functions in infinite series of "fundamental functions" depending on the roots of transcendental equations. Such expansions occur frequently in mathematical physics, the Fourier series being the simplest special case. Steklov introduced the necessary rigorousness into the problems of mathematical physics, in proving the existence of the solutions and the conditions of convergence for the series used. He summarised his researches in a treatise "On

the Differential Equations of Mathematical Physics" recently published by the Russian Academy of Sciences in two volumes. The complete list of his scientific papers contains about 120 items. These papers are published mostly in French, in the *Memoirs of the Russian Academy of Sciences*, the *Annales de l'École Normale Supérieure*, the *Annales de l'Académie de Toulouse*, and others.

As a lecturer Steklov was widely known while he was professor in the higher branches of theoretical mechanics and mathematics, first at Kharkov and then at St. Petersburg (now Leningrad).

Steklov was elected a member of the Russian Academy of Sciences in 1910, and in 1919 became vice-president of the Academy. The task of the vice-president was at that time a most difficult one. The vice-president is responsible for all the administrative work of the Academy and of its numerous institutions; he has to control the yearly expenditure and to superintend the proper use of the funds. Steklov proved to be just as able an administrator as a man of science: with open mind, sound judgment and firm hand, he steered the Academy safely through the hardships of the years 1919–22. A. KRILOFF.

WE regret to announce the following deaths:

Miss Gertrude Bell, oriental secretary to the High Commissioner of the Iraq, Baghdad, since 1920, and distinguished for her travels in and knowledge of the peoples of Arabia, on July 11.

Mr. A. G. Charleton, past president of the Institution of Mining and Metallurgy, and author of numerous works on ore-mining and treatment, on July 7, aged sixty-eight years.

Mr. W. Temple Franks, C.B., lately H.M. Comptroller-General of Patents, Designs, and Trade Marks, on July 4, aged sixty-three years.

Mr. F. Harrison Glew, M.B.E., a pioneer in the utilisation of radium and its salts for the preparation of luminous paint and other purposes, on July 10, aged sixty-eight years.

Sir Peter Scott Lang, emeritus professor of mathematics in the United College at the University of St. Andrews, on July 5, aged seventy-five years.

Dr. George R. Lyman, dean of the West Virginia College of Agriculture at Morgantown and previously pathologist in the Bureau of Plant Industry at Washington, D.C., on June 7, aged fifty-five years.

Rev. T. R. R. Stebbing, F.R.S., the distinguished naturalist and worker on Crustacea, on July 8, aged ninety-one years.

News and Views.

ON July 7, in the presence of a large and representative gathering in a spacious marquee, Mr. Neville Chamberlain laid the foundation stone of the new London School of Hygiene and Tropical Medicine, the result of a gift of 2,000,000 dollars from the trustees of the Rockefeller Foundation. The chairman of the Board of Management, Sir Alfred Mond, in introducing Mr. Neville Chamberlain, reviewed the steps which had led to the foundation of the School. He pointed out that the former Chancellor of the Exchequer, Sir Robert Horne, had recognised the great importance of such an institution and had agreed that the British Government should make itself responsible for its maintenance. As a result of representations made by Mr. Neville Chamberlain to the present Chancellor of the Exchequer the building was being expedited, a grant of 5000*l.* per annum being made by the University Grants Committee and one of 4000*l.* per annum from the Rockefeller trustees for immediate developments. He was able to announce that though Sir Cooper Perry is retiring from the post of Principal Officer of the University of London, his services are being retained on the Board of Management of the School, of which he has consented to be vice-chairman. Mr. Ormsby-Gore, Under-Secretary for the Colonies, in a most lucid and convincing manner, spoke of his recent experiences on a tour of the colonies and his conviction that hygiene and sanitation are the most vital of all the problems connected with the future development of the vast territories under the charge of Great Britain. The importance of a school like that being founded in London could not be overestimated.

MR. NEVILLE CHAMBERLAIN said that the building, the foundation stone of which he was to lay, was a result of co-operation between the two great English-speaking nations. It had been noted that the teaching of public health in London is carried on in a number of separate institutions, and it was realised that its concentration in one school would undoubtedly conduce to greater efficiency in teaching and research work. It was further realised that public health is not only necessary in the British Isles, but is of even greater importance in the tropical possessions of Great Britain. It was this fact which led to the incorporation of the London School of Tropical Medicine, founded in 1899 by Mr. Joseph Chamberlain. The new School would deal with hygiene in its widest applications, and before it lies a future in which it would not only be of national but also of imperial and even world-wide importance. It is probably destined to be famous as the greatest centre in the world for research and instruction on one of the most beneficent of all the activities of the human race. Reviewing the departments of the new School, Mr. Chamberlain said these would comprise: (1) Physiology; (2) chemistry and bio-chemistry; (3) bacteriology and immunology; (4) epidemiology and vital statistics; (5) medical biology; (6) sanitary science and public health in general. The School would be fitted with the latest types of apparatus and equipment, and would develop a great teaching museum in graphic form, intended not only for the student of hygiene but also for those of the general public who would care to visit it. With this programme before it there is every prospect that post-graduate students would gather from all parts of the world, and there can be little question that men and women will receive the best possible instruction in the methods of disease prevention. After the foundation stone had been laid Dr. Andrew Balfour, Director of the School, presented Mr. Neville Chamberlain and Mr. Ormsby-Gore with seals as mementoes of the

important occasion, the success of which they had so ably ensured.

AT 29 Great Pulteney Street, Bath, a corporation committee, under the chairmanship of Mr. T. Sturge Cotterell, has erected the forty-second mural tablet in commemoration of distinguished people definitely connected with the city. This last one states that "In this house William Smith, the Father of English Geology, dictated 'The Order of the Strata,' December 11th, 1799." The house was that of the Rev. Joseph Townsend, and it was the Rev. Benjamin Richardson who held the pen. This, the first written statement of Smith's ideas, was distributed in many copies to geologists at home and abroad. The tablet was unveiled on July 10 by the president of the Geological Society of London, Dr. F. A. Bather, in the presence of the mayor and a company that included many leading geologists. The chief guests were entertained to lunch at the Guildhall by the mayor (Mr. Cedric Chivers) and mayoress (Madame Sarah Grand), after which a meeting at the Royal Literary and Scientific Institution was addressed by Dr. Bather.

DR. BATHER showed in his address how the conclusions of William Smith flowed naturally from his surveying work in the neighbourhood of Bath, and how the society of the city afforded a fertile field for their reception. Smith's leading ideas, a revelation to his contemporaries, formed the starting-point and the necessary foundation of all tectonic and all historical geology; they have been the only sure guide in the great industries of coal-mining and oil-getting; and they alone have afforded the proofs without which evolution would have remained an ineffective dream. Prof. W. B. Scott, of Princeton, emphasised some of these thoughts by reminding the company that Hutton himself had not conceived the possibility of an historical geology, and that among those who failed to understand the principles of William Smith even Herbert Spencer could be reckoned. Among other speakers were Profs. S. H. Reynolds and H. L. Hawkins, and the chairman, Mr. P. E. Martineau, who is doing so much to revive the geological museum of the Institution.

MATHEMATICIANS usually look to the British Association only to satisfy their curiosity as to progress in other subjects than their own, but for this year's meeting at Oxford an attempt is being made to provide a broad platform for expression among themselves. On three mornings Section A will divide, mathematics separating from astronomy and physics, and several speakers have undertaken to describe in terms intelligible to mathematicians generally, not merely to experts in one branch or another, recent lines of advance and outstanding problems that are being attacked in mathematics itself. Subjects are found in mathematical logic and in rational dynamics as well as in the central regions of analysis, and every problem is to be expounded by some one who is at work upon it. It rests with the mathematicians of Great Britain, amateur as well as professional, from the schools as well as from the universities, to prove by their attendance that an effort to give in simple language some idea of the present vitality of mathematics appeals to a genuine interest. Only a fraction of the possible subjects can be touched at one meeting, and if this year's experiment is successful, the British Association will have discovered a function which can be continued beyond the circle surrounding its present origin and may even be found to be regular almost everywhere.

THE interesting lecture given by Mr. C. F. Elwell on May 5 to the Royal Society of Arts on the past, present, and future of radio is published in the June number of the Society's journal. He divides the subject into radio telegraphy, telephony, and miscellaneous applications. He points out that it is possible to talk to ships at sea by an ordinary subscriber's telephone. Such relaying of wire line telephony has even been done after the speech has been transmitted 5500 miles. The rapid progress of broadcasting is due to the demand for it. There are already two million receiving sets in use in Great Britain, and five million in the United States. There is a field for the transmission of speech by radio over electric light wires and transmission lines. Considerable progress has already been made in this direction in Italy, Germany, and the United States. It will do much to relieve the overcrowded ether. The three-electrode valve has already cheapened the cost and considerably extended the field of telephony. A few years ago, conductors weighing 150 lb. per mile were necessary for long-distance transmission. Better speech is now possible over greater distances with conductors of only one-fifth the weight. Considering that millions of miles of telephone circuits are in existence and that extensive developments are in progress, the value of the copper that is being saved is very large. A picture of a cheque has been sent across the Atlantic by radio and has been honoured within an hour of its receipt. It is possible that picture films may be sent by radio. In the art of television notable progress is being made by J. L. Baird, and developments may be expected. Many problems in connexion with the prevention of collisions at sea and between aeroplanes in the air still remain to be solved. A solution of one of these problems would probably also be applicable to the other. Even in competition with submarine telegraphy, radio is making progress. Radio telegraphy carries 30 per cent. of the message traffic across the Atlantic.

ACCORDING to a telegram of July 6 from The Hague (printed in the *Times* for July 7), another serious earthquake since June 28 has occurred on the west coast of Sumatra, but the date is not given. The epicentre is said to lie between Fort de Kock and Solok—that is, some miles to the north or north-east of Padang. The brick houses that withstood the earlier shock were destroyed and the number of lives lost is placed at 400. The recent shocks occurred in a district lying many miles to the north-west of that visited by the great earthquake of June 12, 1893, but in a part of the island disturbed from time to time by destructive earthquakes, one of the most important being that of May 17, 1892. This latter

earthquake is of interest, as it was the earliest in which crust-movements were measured by a repeated triangulation of the district. Prof. H. F. Reid, from a study of the displacements (*Bull. Seis. Soc. Amer.*, vol. 3, 1913, pp. 72-79), infers that the movements took place horizontally along a N.N.W.—S.S.E. fault 150 or 200 km. in length, the west side moving to the N.N.W. and the east side to the S.S.E., the total relative slip being 3·5 or 4 metres. The movements, both in nature and amount, bear a close resemblance to those which took place along the San Andreas fault at the time of the Californian earthquake of 1906.

REPLYING to a question in the House of Commons on July 12, Mr. Ormsby-Gore, Under-Secretary for the Colonies, said that arrangements have been made by the Department of Scientific and Industrial Research for communicating regularly published and other information as to the work done under its auspices to Dominion Government research organisations, to the principal unofficial research centres, and to the Governments of India and the Colonies. In return, valuable information is being received by the Department from the oversea parts of the Empire. Similar arrangements for the exchange of information on agricultural research are in force; and it is proposed that a conference on the subject of inter-Imperial co-operation in agricultural research shall be held in the autumn of 1927. Invitations to this conference were issued last year to the Governments of the Dominions, Colonies, and Protectorates.

A MEMORIAL tablet has been placed in the Dominion Archives building, Ottawa, in memory of sixteen members of the Canadian Arctic Expedition, 1913–18, who perished during the expedition in widely separated sections of the Arctic. In addition to the inscription "in memory of those who perished, Canadian Arctic Expedition, 1913–18," and the names in alphabetical order with the ranking of each, there is an inscription at the foot of the tablet: "for Canada and for Science—pour la patrie et pour la science." Of the five members of the scientific staff who are thus commemorated, one is a Canadian, son of the late Dr. A. E. Malloch, of Hamilton, Ontario, and a member of the Geological Survey of Canada. Henri Beuchat, anthropologist, was a distinguished writer on American archæology and ethnology from Paris. Bjarne Mamen, topographer of Oslo, Norway, had served on the Norwegian-Spitsbergen Expedition before taking part in the Canadian expedition. James Murray, oceanographer, and Alister Forbes Mackay, surgeon, were from Scotland, and had been with Shackleton in the Antarctic. Peter Bernard, master of the *Mary Sachs*, a native of Prince Edward Island, lost his life, as did Charles Thompson, seaman, while crossing Banks Island in the winter of 1916–17. André Norem, Daniel Wallace Blue and John Jones were buried on the north coast of Alaska, Baillie Island and Victoria Island, N.W.T. After the sinking of the *D. G. S. Karluk*, north of Siberia, in January 1914, four men were lost attempting to reach Wrangel Island over the sea ice: James Murray, Alister Forbes Mackay, Henri Beuchat, and a seaman, Stanley Morris. Another party of four, led by First Mate Alexander Anderson, consisting of Charles Barker, John Brady and Edmund Golightly, seamen, succeeded in reaching Herald Island, but their fate was not known until a whaling vessel calling at the island in 1924 discovered the relics of the party on the beach. George Breddy, seaman, died on Wrangel Island, as the result of an accidental gunshot wound, and George Malloch and Bjarne Mamen, perished from scurvy at Rodger's Harbour, Wrangel Island, in May 1914.

SIR J. C. BOSE, of Calcutta, has been giving lectures and demonstrations recently in Great Britain on plant stimulus and response. This is a subject to which he has devoted his energies for many years, and he has devised various delicate instruments for magnifying the minute responses of the plant to stimuli. Plant physiologists have not hastened to take up the use of such instruments, which would surely by their delicacy yield interesting results in the hands of any skilled experimenter. There is still much to learn about plant response, and Sir Jagadis has done useful work in directing attention to the delicacy of the plant as a responding mechanism. In a recent lecture at the Royal Society of Arts he referred to the sensitiveness of the plant to ether vibrations, not only to visible light but also to the ultra-violet and to octaves of long invisible waves. He also referred to the death spasm accompanied by an electric discharge, which he believes to take place when the plant dies but before it begins to droop and wither.

THE memory of Benjamin Harrison and his life-long devotion to archæology, and particularly to the study of the evidence of man's earliest handiwork in the form of stone implements, will be appropriately preserved as a result of the efforts of the promoters of the "Benjamin Harrison Memorial Fund." On Saturday last, July 10, a tablet to his memory was unveiled in Ightham Church, and as part of the memorial ceremony the title-deeds of the Coldrum Stone Circle at Trottiscliffe, Kent, which has been purchased out of the contributions to the Fund, were handed over to the National Trust. Admirers of Benjamin Harrison, who are many, will be gratified that the preservation of this most interesting relic of early man should be assured, and that it should be associated with the memory of one of the most devoted of the pioneers in archæological studies in England.

A LETTER from Lord Onslow appears in the July issue of *Man*, putting forward a plea for the preservation of specimens of ethnographical interest in Great Britain at present in private hands. It is pointed out that the nineteenth century being primarily a century of settlement, as opposed to the two preceding centuries which constituted the age of discovery, it was pre-eminently the century of the collector, and there must remain in private hands a large number of ethnographical objects which were acquired before their use among primitive peoples had been superseded by articles of European manufacture. If immediate steps are taken, it should be possible to preserve a large number of objects of great ethno-

graphical and historic value, and in many cases to record their history and provenance. The Council of the Royal Anthropological Institute has appointed a committee to explore the possibilities of the situation. Lord Onslow has consented to act as chairman of the Committee.

WE are glad to know that it is proposed to establish a memorial to the late Mr. F. S. Spiers, secretary of the Faraday Society and of the Institute of Physics, to remind future generations of his valuable services to science and human welfare. It is suggested that a memorial lecture, to be paid for out of the interest on the fund subscribed, shall be instituted under the auspices of the Faraday Society. A committee to promote this appeal has been formed, with Sir William Bragg as chairman, and the sum of about 130*l.* has already been subscribed. We are sure that many who have been associated with Mr. Spiers in scientific meetings and the preparation of papers and reports will desire to add to this sum. Contributions should be sent to the assistant honorary secretary, Miss M. Parsons, of the Faraday Society and the Institute of Physics, at 90 Great Russell Street, W.C.1. Cheques should be made payable to Prof. A. W. Porter and crossed "F. S. Spiers Memorial Fund A/c."

ARRANGEMENTS are being made by the Regional Survey Association to hold a meeting at Richmond, Yorkshire, on September 1-10 next. The district, which is rich in historical associations and natural beauty, will be studied from as many points of view as possible—physical, geographical, historical and social. Lectures will be given by specialists in these subjects, and these will be supplemented by practical work and observational excursions in the neighbourhood. The latter will cover Barnard Castle, Muker and Keld, Leyburn in Wensleydale and Catterick Bridge, localities which will afford exceptionally favourable fields for research. Full particulars may be obtained from the Secretary, Leplay House, Belgrave Road, London, S.W.1.

THE report on the Health of the Army for the Year 1924 has recently been issued (London: H.M. Stationery Office, 1926. 3*s.* 6*d.* net). Efforts have been made to expedite issue, with the result that this report appears within about four months of its predecessor. A melancholy interest attaches to it, for it is signed by the late Sir William B. Leishman, Director-General, A.M.S. The improvement in the health of the troops, noted in previous reports, was maintained during 1924, with the exception that the admission ratio shows a fractional increase over 1924, due to influenza. Tonsillitis again caused a large number of admissions to hospital, and middle ear disease heads the list of diseases causing the greatest loss of men through invaliding. Interesting details are given both of the medical measures and equipment employed in the army in the treatment of disease and of the hygienic and other measures now taken to prevent disease and to improve the lot of the soldier.

THE technical programme has now been issued of the sectional meeting of the World Power Conference, to be held at Basle on August 31-September 8 in the halls of the International Exhibition for Navigation and Utilisation of Hydraulic Power. Five broad subjects of discussion have been arranged: (*a*) utilisation of water power and inland navigation, (*b*) exchange of electrical energy between countries, (*c*) relation between the hydraulic and thermal methods of generating electricity, (*d*) electricity in agriculture, (*e*) railway electrification. At the conclusion of the meeting, an official tour of Switzerland will be made, lasting from September 9 until September 12. Communications for the British National Committee should be addressed to the Secretary, World Power Conference, 36 Kingsway, London, W.C.2.

ON May 30, Dr. Truman Michelson, of the Bureau of American Ethnology, left Washington for the reservation of the Fox Indians at Tama, Iowa, where he will study the ritual of the religious ceremonies which are held in the spring and autumn. He will afterwards proceed to Wyoming to study the language of the Arapaho, which appears to be a widely divergent derivative of Algonquin. This is the fifteenth consecutive season that Dr. Michelson has spent among the Fox Indians, from whom he has collected a large amount of anthropological material. Some of this material appears in the latest volume published by the Bureau of American Ethnology, but the greater part awaits publication owing to the lack of funds. This is the more to be regretted as the Fox are a reticent people with an interesting history—they contributed materially to the loss of Canada by the French to the British by breaking up the trade route from Louisiana to Canada—and although they suffered some admixture with European blood in the early days of American colonisation, they have since stubbornly maintained their racial purity.

AN announcement has been issued of the fifth competition, for 1926, for the Patxot prize, which was instituted in 1922, primarily to stimulate research in Catalonia in the physical sciences and mathematics, by M. Raphaël Patxot i Jubert. The prize for 1926 will be 5000 pesetas (present value about 160*l.*), and the jury of award will consist of two specialists and the founder of the prize, who retains rights of publication. Competing works should be addressed to Rue de la Cucurulla, 1 et 3, Barcelona, and must be received by December 31, 1927. They may be in Catalan, any Latin tongue, or English, and the subject is the meteorology of the western Mediterranean, and more especially of the Catalan coast. One competition for 1924 (10,000 pesetas) for a documented monograph relating to the history of the physical sciences or mathematics in Catalonia in the Middle Ages, closes on December 31, 1928. Another prize for 1924 was not awarded, although three memoirs on physiographic studies of Catalonia were entered, for which minor awards were given. The prize for 1925 (5000 pesetas), which closes on December 31, 1926, is for a monograph in Catalan on atmospheric physics applied to Catalonia.

UPON its title page the *Journal of the Royal Agricultural Society of England* bears the Society's distinctive motto "Practice with Science." In view of the latter epithet it is entitled to notice here. Under the heading "Special Articles" there are in vol. 86 eight papers, of which many of the authors bear well-known names either in 'Practice' or 'Science.' The most arresting contribution is one on the "Use of the Dynamometer in Soil Cultivation Studies" by Dr. Keen, of Rothamsted. This gives a summary of the novel results obtained by the use, for the first time, of an instrument of real precision in measuring the draft of tillage implements, the unexpected result being that draft does not necessarily increase *pro rata* (even in linear dimensions) with speed. In regard to tillage problems, however, one may be permitted to suggest (as Wren Hoskyns believed almost a century ago) that the future of economical tillage lies with a rotary implement rather than with the plough, designed, as the latter is, to suit the slow-moving ox or horse. The Oxford Research Institute in Economics contributes a timely article on the sugar-beet position. For the first time in the rather turgid literature on this subject, attention is directed to the fact that the introduction of this crop on any extensive scale necessarily contracts, in a serious degree, the provision of animal food, and consequently raises questions of fundamental economic importance to British farming, dependent as this is, to a pre-eminent degree, on animal husbandry. The Society has recently established a Research Committee, but judging by its present report its title should be, with greater justice, the Field Investigation Committee; for it is almost wholly concerned with interesting and valuable practical trials in such subjects as green manuring, lucerne growing, malting barley trials, grassland improvement, and so forth.

PROF. A. F. VON EISELSBERG, professor of surgery in the University of Vienna, has been awarded the Lister medal, given by the Royal College of Surgeons of England, for distinguished contributions to surgical science.

THE Council of the National Institute of Agricultural Botany has awarded the Snell Memorial Medal for the year 1925 to Dr. R. N. Salaman. The medal is given annually to mark distinguished work in the sphere of potato husbandry, and has been awarded to Dr. Salaman in recognition of his eminent services in the study of the problems connected with the breeding and the diseases of potatoes. The medal will be presented to Dr. Salaman at the public inspection of the trials at the Potato Testing Station, Ormskirk, on August 19.

PROF. CARL DIENER, professor of palæontology in the University of Vienna, has been elected a foreign member of the Geological Society. The following have been elected foreign associates of the Society: Dr. A. L. Day, of the Geophysical Laboratory, Washington, D.C.; Prof. Otto Jækel, professor of geology and palæontology in the University of Greifswald; Prof. Maximin Lohest, professor of geology and physical geography in the University of Liège; and Prof. Pierre Pruvost, professor of geology and applied mineralogy in the University of Lille.

THE Vienna Academy of Sciences has elected as honorary member Dr. Ernst Fuchs, emeritus professor of ophthalmology in the University of Vienna, and the following as foreign corresponding members: Prof. G. H. Hardy of Oxford, Dr. C. V. L. Charlier of Lund, Dr. S. Ramon y Cajal of Madrid, Dr. O. Richter of Brünn. Prizes have been awarded to Dr. A. Franke for his work on the formation and transformation of glycols, and to Dr. G. Stetter for his work on the determination of the masses of atomic fragments. The prize offered at the instigation of Dr. Hans Vaihinger, president of the Philosophical Society "As-if," for an essay on "Fictions in Mathematics" has been awarded to Dr. C. Betsch of Kannstatt, and Dr. M. Draeger of Chemnitz has been highly commended.

THE publication of the *British Journal of Experimental Biology* has been undertaken by the Cambridge University Press. It is the organ of the Society for Experimental Biology, but contributions are accepted from other than members of that body. It is edited by Mr. J. Gray, with the assistance of Dr. F. A. E. Crew and others.

MESSRS. Dulau and Co., Ltd., 34 Margaret Street, W.1, have just issued a useful catalogue (No. 143) of some 1200 second-hand books on phyto-pathology and horticulture. It is conveniently arranged under the headings: phyto-pathology, fungi, mosses and hepatics, lichens, diatoms and desmids, algæ and plankton, ferns and lycopods, cryptogamia, botany, floras, gardening, herbals, etc.; and agriculture and economic botany.

ANOTHER of Messrs. H. Sotheran and Co.'s well-known catalogues has just reached us. Its number is 800 (or "Catalogue of Science and Technology," No. 111, Part vii.: x. and xi.), and in it are particulars of nearly 4000 second-hand works on chemistry and chemical technology. The classification is as carefully carried out as in earlier parts of the catalogue, and there are the valuable bibliographic details and comments which one looks for in this publication which is of the greatest usefulness to collectors and librarians of scientific publications. Applications for the catalogue should be made to Messrs. H. Sotheran and Co., 140 Strand, W.C.2.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:—An assistant lecturer in the Education Department of the University of Leeds with, preferably, qualifications and experience in teaching science or geography—The Registrar (July 19). A demonstrator in mathematics at the Royal College of Science, and a demonstrator in mathematics at the City and Guilds (Engineering) College—The Secretary, Imperial College of Science and Technology, South Kensington, S.W. 7 (July 26). An assistant librarian at the University College of North Wales, Bangor—The Registrar (July 26). A lecturer in physical chemistry in University College, Dundee—The Secretary and Registrar, The Uni-

versity, St. Andrews (August 16). A lecturer in zoology at Armstrong College, Newcastle-upon-Tyne—The Registrar (August 28). A principal of the University College of North Wales, Bangor—The Registrar (October 1). A chief science mistress at the County School for Girls, Beckenham; or a temporary post until Christmas and a permanent post in September or January—The Head Mistress (marked 'Science Post'). Directors of propaganda for calcium cyanamide in India and in Ceylon respectively—The Director of Propaganda for Calcium Cyanamide, Adelaide House, King William Street, E.C.4. An assistant entomologist under the Empire Cotton Growing Corporation for work on cotton pests in the Union of South Africa—The Secretary, Empire Cotton Growing Corporation, 2 Wood Street, Westminster, S.W.1. An assistant master at Soham Grammar School to take charge of practical instruction in Nature study, horticulture, and the elements of agricultural science—The Secretary for Education, County Hall, Cambridge.

ERRATUM.—In the issue of July 10, p. 64, col. 1, line 21 of paragraph on "Silver Iodide in Gelatin Iodo-bromide Emulsions": for "440 mm." read "440 μμ."

Our Astronomical Column.

FINLAY'S COMET.—Mr. S. Hasunuma, of Tokyo, who has calculated the perturbations of Finlay's comet (*Astr. Nach.* 5453), finds that they delay the perihelion passage until August 7, which is some six weeks later than the approximate value assumed in the B.A.A. Handbook. The effect is to bring the comet into a more favourable position for observation, so that its detection this summer is now quite probable. The following ephemeris for 0^h is based on perihelion August 3·0.

	R.A.	N. Decl.
July 18.	$3^h\ 3{\cdot}7^m$	13° 48′
,, 26.	3 40·9	16 38
Aug. 3.	4 16·9	18 56

A change of +4 days in perihelion date diminishes the R.A. by about 10^m and the Decl. by about 90′. The comet must be looked for low in the east just before dawn.

THE COMING PERSEIDS.—The earlier meteors of this famous shower have been perceptible since the opening of July, and it is very interesting to trace the development of the display and the motion of its radiant from night to night through the constellations of Andromeda and Perseus.

This year should provide a shower of more than usually prominent character, for the moon will be new on August 8 and practically invisible at the period of the maximum.

The radiant moves E.S.E. in a line corresponding to 39° north of the ecliptic, and its positions on four dates in July, August, and September are as follow:

		Star near
July 15 . .	15° +47°	Psi Andromedæ.
August 1 .	31° +52°	10° N. Gamma Andromedæ.
August 15 .	49° +57½°	8½° N. Alpha Persei.
September 1 .	69° +61½°	2° W. Beta Camelopardalis.

New observations should be applied to test the accuracy of these approximate positions. The Perseids usually leave streaks, and these are occasionally very enduring in the case of the brighter meteors, so that their directions of flight may be recorded with considerable fidelity.

Some hundreds of the Perseids have had their real paths computed, and there seems little necessity for further data of this sort except on nights near the commencement or end of the display, when double observations will give good and certain radiants. It will be interesting, however, to learn more of the minor contemporary showers. Observers, in comparing one year's results with others, should make such allowances as appear to be required respecting the weather, moonlight, etc. The hours of observation are also important as greatly affecting the altitude of the radiant and the number of meteors distributed.

THE SIMEIS OBSERVATORY REFLECTING TELESCOPE.—The report of the Pulkovo Observatory for 1925 has been published. The most important work done during this year is considered to be the erecting of the 40 inch (1 metre) reflecting telescope at the Simeis Observatory in the Crimea, which is affiliated to the Pulkovo Observatory. The reflector was made at the works of Sir Howard Grubb and Sons, Ltd., and a brief description of it is to be found in NATURE of April 12, 1924 (vol. 113, p. 550).

In the report some interesting details are given relating to the erection of the instrument. The masonry was started on June 6, 1925, and at the beginning of November the mechanical parts of the revolving dome were so far ready that the erection of the reflector could be proceeded with. Finally the large mirror was inserted in its case with great precautions, and was fixed to the tube.

By the end of the year the reflector was mounted, with the exception of the clock-work. Movement of the instrument by hand is easy, although the total weight is 6½ tons. The mechanical parts of the instrument work perfectly, the construction being the highest type of technical achievement.

The programme of research being dependent on the quality of the mirror, a preliminary laboratory test was made during the summer months by Hartmann's method at the centre of curvature of the mirror. The conditions during the test were purposely chosen far from favourable and approximated closely to the average conditions in the dome. Quite apart from the mounting, it is very important to have a thorough knowledge of the shape of the mirror. A series of independent photographs were taken on different days and were examined, in order to get an idea of the mirror's shape. The following details are noteworthy. The results of measurements of different photographs taken on the same day give very nearly the same results. The zonal aberration is exceedingly small, of the same order as the errors of measurement. The average departure in different zones is about 0·03 mm. The accuracy of the configuration of the mirror (departure from a paraboloid) is of the order of $\frac{1}{10}$ of a wave-length. According to Hartmann's classification, the mirror may be considered as "hervorragend gut" (exceedingly good). The results of the analysis leave no doubt that the mirror has a perfect shape, and in comparison with data published for other big mirrors it certainly ranks among the best.

Research with such an excellent instrument on both the mechanical and the optical sides is expected to give good results in the various interesting problems for which the instrument is intended to be used.

Research Items.

RELATIVE VALUE OF FACTORS INFLUENCING INFANT WELFARE.—In Parts 3 and 4 of the first volume of *Annals of Eugenics*, Miss Ethel M. Elderton concludes her exhaustive study of data from Rochdale, Bradford, Blackburn, Preston and Salford on infant viability and summarises her conclusions. These, both positive and negative, are of fundamental importance. The factors, which are shown to be more or less closely associated with viability, are the health of the mother, the health of the baby at birth and, of much less significance, the maturity of the mother and the position of the child in the family. The evidence is conflicting; but in some towns there appears to be a rather heavier death-rate among the infants of women under twenty-three years of age. Miss Elderton has also formed the opinion that there is a higher infant death-rate among the first-born which may be concealed during epidemics of diarrhœa. Association with the habits of the parents and the occupation of the father is small; so is that with all other environmental conditions, *e.g.* poverty, whether judged by the income of the family or the wage of the man, and housing; while no evidence is afforded that children born at the end of a large family suffer in vitality, or that bottle-feeding in itself causes a high infant mortality. Nor, so far as infant mortality is concerned, has indoor sanitation any advantage over outdoor sanitation. The whole trend of the evidence is in favour of the view that the infant death-rate is selective. From the point of view of the race, also, the success of health visitation and inspection is in the right quarter, tending to assist chiefly the better portion of the community. Miss Elderton urges very strongly the need for fuller information to decide whether parental health and habits cause environmental conditions or whether these are responsible for parental health and habits. Much of the available evidence favours the first of these alternatives.

TEARS.—Prof. Maurice Canney, in the *Journal of the Manchester Egyptian and Oriental Society*, No. 12, points out that there is a curious resemblance in birth and death ceremonies which may be due to the fact that birth, marriage, and death all mark a change of state, and the ceremony may be one of initiation into new life. Though it may be natural to express grief by howling, wailing, and weeping, much depends upon how things are done. Though black is sometimes stated always to have been a symbol of death, it seems frequently to have been of life-giving significance, as, for example, in the use of antimony and henna as applied to new-born babes in Egypt. In the case of tears, two ideas have intermingled, but in a civilised community tears are almost exclusively connected with grief and pain, excluding the idea of life-giving, which is really the more primitive. The ceremonial weeping and bawling, which is a feature of mourning ritual in, for example, China, Africa, and elsewhere, clearly has a special significance, its object being not to express grief, but to awaken and reanimate the dead. Tears may be compared to the shedding of blood. The ceremony of cutting oneself for the dead renewed the bond of union with the living. Further, tears being creative, they are potent to produce fertility and ensure good crops. Hence in a number of instances in human sacrifices, the victims are frequently tortured to make them shed tears.

PREHISTORIC EARTHWORKS IN NORTH CARDIGANSHIRE.—A regional survey of the prehistoric earthworks of North Cardiganshire by Mr. I. T. Hughes in vol. 4 of the *Transactions of the Cardiganshire Antiquarian Society* gives a summary description, with plans, of 28 earthworks which can be classified as true 'hill-top' camps. They are confined to a region north of a line drawn from the sea near Llanrhystyd along the Wyre Valley to Trawscoed, then towards Ystrad Meurig and along the valley of the Upper Teifi. There is, however, an important group along the Aeron Valley. North of the Wyre—Upper Teifi line they are isolated from the camps of western Montgomeryshire by the Plynlimon Range. No camp is below the 300 ft. contour and four are above the 1000 ft. range. The upward limit of camps coincides with that of cultivation and modern habitation. Some of the camps are situated in proximity to the sea and defend inland routes, and the distribution suggests that Llanrhystyd was a port of some importance, probably connected with the south coast of England by the conjectural Bronze Age route Southampton—Harlech with a branch from Evesham, "aiming probably at Aberystwyth or some port south of that town." The chief metalliferous areas of Cardiganshire are characterised by groups of camps. Place names associated with the camps near the sea, the valleys and the mining areas suggest Irish affinities which are supported by finds of a halberd, a flat celt, and a palstave of Irish design. The camps, therefore, would appear to be the centres of a community of Goidelic lead lords with close connexions with Ireland. Without the evidence of the spade it would be unwise to offer an opinion as to their age.

SOIL PROBLEMS IN COTTON-GROWING IN THE SUDAN.—The Sudan Government has published (Khartoum, January 1926) the report of a meeting of the chemical section of the Wellcome Tropical Research Laboratories, held at Wad Medani, in which the problems of cotton-growing in the Sudan Gezira were passed in review from the point of view of chemist, physicist, and biologist. This review is particularly noteworthy on account of Dr. E. M. Crowther's discussion of the effect of the nitrogen supply. It appears that, after the water supply, the most important soil factor in the Gezira is the nitrogen supply. Cotton cultivation in the Gezira in this respect shows an essential difference from the conditions prevailing in Egypt.

OXYGEN REQUIREMENTS OF FISH.—Data have been presented concerning the oxygen requirements of different kinds of fish at various temperatures by J. A. Gardner (Min. of Agric. and Fisheries Fishery Invest., Ser. I. vol. 3, No. 1, 1926: Report on the Respiratory Exchange in Freshwater Fish, with Suggestions as to Further Investigations. Pp. 17. London: H.M. Stationery Office, 1926. 2*s.* net). At ordinary limits of temperature, the respiratory quotient varies between 0·6 and 1, but the majority lie round 0·8. Trout appear to be more sensitive to rise in temperature than the coarse fish examined. Even 25° C. proved fatal to a large trout, though smaller specimens could be acclimatised to stand 25° for some hours. Goldfish can endure 30° C., but not 35° C.

ASIATIC AND AMERICAN ELEMENTS IN THE LEPIDOPTERAN FAUNA OF POLAR EUROPE.—The well-known Russian lepidopterist Prof. N. I. Kuznecov has been working for many years on the problem of the distribution of lepidoptera in the Polar regions. While a comprehensive work on the subject is in preparation, he publishes some preliminary results of outstanding interest (*Comptes rendus Acad. Scien.*, Leningrad, 1925). Many species of butterflies are characterised

by a discontinuous distribution, being present in polar Europe and in eastern Siberia, but not occurring in the wide area between the Yenisei and the Ural Mountains. This area, corresponding to the West Siberian plain, can only be explained by the West Siberian Sea, which existed in the Oligocene and extended as far southwards as the Aral Sea. This means that the age of the European circumpolar faunal elements, as well as of the Holarctic ones, must be estimated in any case as pre-glacial, or, more precisely, as pre-oligocenic. These pre-oligocænic circumpolar elements are probably autochtonous, which leads to the conclusion that the Arctic faunistic region may be considered as independent of the Palæarctic region. On the problem of possible origin of these ancestral Holarctic elements, which since the Palæogenic times have populated the whole northern zone of both Eurasia and America, Prof. Kuznecov is of the opinion that they originated in the Angaro-American continent, which embraced eastern Siberia and north-western America down to Colorado and the Great Lakes, stretching westwards across northern Siberia to the White Sea.

MEDITERRANEAN STERNOPTYCHIDÆ.—Messrs. P. Jesperson and A. V. Tåning ("Report on the Danish Oceanographical Expeditions, 1908–1910, to the Mediterranean and Adjacent Seas." No. 9, Vol. 2 (Biology). A. 12: "Mediterranean Sternoptychidæ," by P. Jespersen and Å. Vedel Tåning. Copenhagen: Andr. Fred. Høst and Søn, 1926. 35*s*.) continue the systematic account of the fishes belonging to the Sternoptychidæ taken by the Danish Oceanographical Expedition in 1908–1910 under the leadership of Dr. Schmidt. Together with Jesperson's previous report in this series on the genera Argyropelecus and Sternoptyx (Reports, vol. 2, A. 2), it forms a valuable account of the post-larval, adolescent, and where necessary, of the adult stages belonging to the species of this family occurring in the Mediterranean. Many cases of doubtful synonymy are cleared up and a new species of the genus Cyclothone described. Much attention is given to the comparison and identification of the species, and numerous clearly executed figures accompany the text; maps are also given showing the horizontal distribution for each species. The information relating to seasonal, diurnal, and ontogenetic vertical migrations, as well as that relating to the horizontal distribution, is interesting and important. Very young larval forms seem not to have been found except in isolated cases; this being due in the authors' opinion to their small size and delicate nature, and to their destruction by the net. Post-larval forms are generally taken close to the surface, whilst typical metamorphosis stages are found in much deeper water, mainly from 500 to 1200 m.w., depending upon season and geographical locality, and varying for each species; it seems, moreover, that the change in depth of living takes place suddenly, as intermediate stages have not been found at intermediate depths. Diurnal vertical migrations are undertaken by most of the adults, and, generally speaking, they are higher in the water in the summer than in the winter.

BIOMETRIC WORK ON VARIABILITY.—The *Izvestia Buro po Genetik i Eugenik*, No. 4, recently issued by the Russian Bureau of Genetics and Eugenics, contains five biometrical studies on variability, with short summaries in English or German. The longest paper, by Prof. J. Philiptschenko, on the variability of quantitative characters in twelve pure lines of soft wheats, considers the conditions under which relative values or indices are more suitable than absolute values for certain measurements. The resulting correlations are classified as (1) intrabiotypic, depending on reaction-norms within a biotype; and (2) intrapopulative, depending on the relations of the biotypes within a population. T. Liepin, in a study of variability in a Chrysomelid beetle, *Phædon cochleariæ*, finds by measuring larval stages that the variability gradually decreases with age, this decrease being due to internal factors, while unfavourable conditions are shown unexpectedly to cause increased variability. G. Pchakadze finds in *Daphnia pulex* that the young from fertilised eggs are nearly twice as variable as those from parthenogenetic eggs. He also claims that adult parthenogenetic Daphniæ are more variable than adults from fertilised eggs, and that while variability decreases with age in Daphniæ from fertilised eggs, it increases with age in parthenogenetic individuals. D. Diakonov shows briefly that bimodal variation need not necessarily mean genetic dimorphism. A. Zuitin deals with similar problems of variability in the grasshopper, *Dixippus morosus*, which is also parthenogenetic. He finds a decrease of variability during post-embryonic development, but concludes that if environmental conditions overbalance the internal regulatory processes within the animal, an increase of variability with age may result.

SOME PERIODS IN AUSTRALIAN WEATHER.—A discussion, by Dr. Edward Kidson, Assistant Director, Commonwealth Bureau of Meteorology, is published by the Bureau of Meteorology, Melbourne, Commonwealth of Australia, as Paper 1—extract from Bulletin No. 17. Mr. Hunt, the Commonwealth Meteorologist, in the introductory note states that Dr. Kidson has put into more precise form much that has for many years been common knowledge to Australian meteorologists, and he considers the discussion should lead to an advance in our knowledge of meteorological processes in the Australian region. The author has dealt with weather charts for more than thirty years. The close relationship shown between the annual latitude range of anticyclones and the Wolfer sunspot numbers is one of the results.

EARLY POLARISATION APPARATUS.—The issue of *Die Naturwissenschaften* for May 28 contains over the signature Kpl. an illustrated account of an apparatus for investigating the polarisation of light by reflection shown by J. Tobias Mayer to the Gesellschaft der Wissenschaften of Göttingen on November 21, 1812. It consisted of two parallel glass plates the back surfaces of which were blackened; the upper one received sunlight and reflected it vertically downwards to the second, which could be rotated about a vertical axis. It was, therefore, the apparatus now known as Norremberg's, although there appears to be no record of Norremberg having constructed his apparatus before 1842. Mayer's paper will be found in *Commentationes Soc. reg. scien. Göttingen*, 1813, No. 9.

THE ATOMIC NUCLEUS.—The most recent of the suggestions as to the constitution of the atomic nucleus is that made by S. Ono in the April issue of the *Proceedings of the Physico-Mathematical Society of Japan*. He suggests that the nucleus consists of two parts, an inner and an outer. In the inner portion each proton or positively charged elementary particle is accompanied by an electron, while in the outer part each pair of protons has an electron. The volume occupied by the outer combination is on the average 1·1 times that occupied by the inner, and the combinations are uniformly distributed, the inner through the volume of a sphere, the outer through the shell surrounding the sphere, its outer radius

being on the average 0·6 times the diameter of an outer combination greater than that of the sphere. On this supposition the relation between the atomic numbers and the atomic weights of the heavier elements comes out in close agreement with the facts, but the number of possible isotopes is in excess of those found. Two groups projected from the outer nucleus constitute an α-ray, and the disturbance of the equilibrium of the atom results in the emission of two electrons from the rings outside the nucleus —the β-rays, which it is known are emitted in pairs.

PROTECTION AGAINST IGNITION BY PERFORATED PLATES.—It is rather astonishing to read of and more astonishing to see red flames—several inches in height—emerging through perforations in a metal plate into an explosive mixture of gases without igniting the mixture. Nevertheless this may be seen in the laboratories of the Safety in Mines Research Board at Sheffield, and the description of the experiments may be read in the second report on flameproof electrical apparatus with perforated-plate protection (Mines Department: Safety in Mines Research Board. Paper No. 21: Flameproof Electrical Apparatus for use in Coal Mines. Second Report: Perforated Plate Protection. London: H.M. Stationery Office, 1926. 1*s*. 3*d*. net). Messrs. Wheeler and Grice have shown experimentally that by allowing the escape of burning gases (produced by the explosion of fire-damp and air in a bomb) through suitably spaced holes in a metal plate, the escaping gases—still visibly burning—may be so cooled down by conduction and expansion as to be incapable of igniting a 10 per cent. methane-air mixture surrounding the bomb. When two suitably perforated brass sheets, such as are manufactured commercially, are superposed—with a small interval between them—as part of the cover of a switch-box, an explosive methane mixture can be fired inside the box without igniting a similar mixture outside.

COMBUSTION UNDER DIRECT ELECTRICAL DISCHARGE. — In an interesting paper published in a recent number of the *Proceedings of the Royal Society*, Messrs G. I. Finch and L. G. Cowen describe their experiments on the combustion taking place when a direct discharge is maintained between metallic electrodes in electrolytic gas at pressures between 20 mm. and 100 mm. of mercury. In the inflammation of gases there is a pre-flame period of slow combustion when chemical combination begins; this process usually increases automatically in intensity until the normal flame appears. But it is possible to maintain the flameless regime under special conditions. Some twenty years ago, Kirkby found that when a direct discharge was maintained in electrolytic gas under low pressures, the water formed (without flame) was proportional to the quantity of electricity passed, and that the combustion was independent of the nature of the electrodes and occurred at all points of the discharge. Later workers have chiefly studied ignitions by high-tension discharges from a coil or by capacity-discharges from a condenser. The present authors have sought to eliminate so far as possible all 'capacity' effects, and to maintain a perfectly steady discharge with a glow free from striations and flickering—so that the combination might be related only to ionisation and not be due to high temperature. Under the conditions maintained by the authors, the rate of formation of water was found to be directly proportional to the current. By limiting the current, the combination may be confined to the glow round the cathode, when it is independent of the gas temperature and pressure, but varies with the nature of the electrodes.

DIRECTION FINDING BY RADIO.—The Department of Scientific and Industrial Research has just issued the third part of the report on the variations of the apparent bearings of radio transmitting stations. This report gives the results of observations carried out by Dr. Smith-Rose between November 1922 and March 1924 on ship and shore transmitting stations. (Department of Scientific and Industrial Research: Radio Research. Special Report No. 4: Variations of Apparent Bearings of Radio Transmitting Stations. Part 3: Observations on Ship and Shore Transmitting Stations, November 1922-March 1924. London: H.M. Stationery Office, 1926. 2*s*. 6*d*. net.) The previous report describes observations using wave-lengths varying from 2000 to 9000 metres. In the experiments now described, special attention was given to a wave-length of 450 metres as this was the length in general use for every day direction finding during this period. Two land stations were mainly used for the test, the Admiralty station at Orford on the east coast of England and the Radio Research Board's station at Slough. Tests were also made on board ship. It was observed that with the short wave-length of 450 metres there was a tendency for the occurrence of 'blurred' minima which annoy observers. From the point of view of navigation an important result was proved. It was found that the existence of fog had little or no effect in producing errors. On one occasion in particular, although the fog was spread over Great Britain and a large portion of western Europe, yet the directional effects showed only the usual day and night variations. As it is chiefly during foggy weather that direction finding stations are called into action, this result is most satisfactory. Again, when the weather was cloudy and overcast, no special phenomena were noticed. It seems probable therefore that the cause of the variations is not due to any effects produced by solar radiation on the lower strata of the earth's atmosphere. The report concludes by reference to two recent papers communicated by the author and Mr. Barfield to the Royal Society. In one of these a direct determination of the effective conductivity of the earth is made at radio frequencies. This result is of importance in the general study of wave propagation. In the other and later paper, it is stated that some of the radio waves have travelled through the upper regions of the earth's atmosphere before reaching the detector.

TRANSLUCENCY OF PORCELAINS.—With the view of the improvement of the ceramic industry in the United States, an investigation of the causes of translucency has been carried out by Messrs. C. W. Parmelee, professor of ceramic engineering, and P. W. Ketchum, research assistant in the University of Illinois, and the results are given in Bulletin 154 of the Engineering Experimental Station. The measurements of translucency were made by eye with the aid of a Lummer-Brodhun photometer or by the use of a photo-electric cell, the current from which when illuminated was measured by the change of deflexion of an electrometer. The two methods give relative values in fair agreement with each other, although owing to the reddish colour of the transmitted light the absolute value of the translucency by the cell method is less than that obtained by photometer. Increase of thickness of the specimen decreases the transmitted light in the usual exponential way. High felspar content produces high translucency, while flint has a less marked effect in the same direction. High clay content diminishes translucency. Fine grinding of the constituents raises the translucency in a striking way, and increase of firing temperature produces a further improvement.

Studies in Eugenics and Human Heredity in South Africa.[1]

THESE two papers by Dr. Fantham are welcome evidence of the earnestness with which he is pressing home the social applications of biology in the country in which his lot is cast. Whilst they reiterate to a large extent principles that are well known to readers of NATURE, these principles are exemplified by some interesting original observations made by Dr. Fantham since he began residence in South Africa.

The ultimate aim of zoological science is of course a thorough knowledge of the inner nature of animal life. The intense interest of this aim provides the spur which urges to zoological research in old countries like Great Britain, in which Nature has been thoroughly dominated and tamed, and in which we have to be up and doing if any traces of really wild Nature are to be allowed to persist. But in newer countries like the outlying portions of the British Empire the battle with circumambient wild Nature is at its height, and the ultimate victory is by no means assured, and so the light which zoology (and other sciences) can throw on the conditions which are likely to lead to success in this struggle contitutes their main passport to popular favour.

Now there are two main problems for eugenists which emerge from the study of human heredity; one of these may be described as the problem of the Mendelian recessive; this problem is ubiquitous, and it is this question which especially faces social workers in Great Britain. The other is the problem of the crossing of different races: this, usually denominated miscegenation, is the really burning question in countries like South Africa and the United States of America. It would constitute a problem in Australia, also, had not the Australians adopted one particular solution of it which certainly is effective so long as it is maintained, but their power to maintain it for an indefinite period of time is, to say the least of it, exceedingly doubtful. It seems to us that Dr. Fantham has not kept these two problems sufficiently distinct in his mind, for we are convinced that they are entirely different in their nature. The term "Mendelian recessive" is meant to denote those defective individuals, constantly turning up amongst modern civilised men, whose defective characteristics are transmitted to posterity in a way which suggests that their inheritance follows the laws of Mendel.

The defects are, however, by no means always recessive. In fact, it seems to us that the importance of the contrast between dominant and recessive characters has been greatly exaggerated by Mendelian writers. What is usually termed a 'mutation,' that is, a sudden divergence from the type, almost always shows a peculiar character which bestows on these 'mutations' a family likeness wherever they may occur. This character is a constitutional weakness as compared with the type, and the question of dominance and recessiveness is merely the question of whether the weakness is or is not sufficiently marked to make itself felt in the F_1 generation where it enters the germ from one side only of the house. These defects show themselves in external marks of the most varied kind, such as brachydactyly (the shortening of the digits accompanied by the fusion of two of the joints), polydactyly (extra toes and fingers), hæmophilia (inability of the blood to clot), night-blindness (loss of the power to see in the dusk), and, most important of all, defective development of the brain or feeble-mindedness. Dr. Fantham quotes some well-known pedigrees, but he also gives examples from his own observations of the inheritance through three generations of such defects as 'stiff fingers' (orthodactyly), permanently bent little finger, premature baldness on the crown of the head, white forelock, and supernumerary thumbs. The inheritance of this last case is very instructive, for the trait was first noted on the left hand and it appeared in the next generation on the right hand. This shows that the character was not due to a 'gene' or 'factor' which initiated an extra growth at a particular place, but to an interference with the normal processes of growth, and there is a strong suspicion that this interference was a too tightly-constricting amnion in the latest stages of development which impinged on and split the thumb rudiment into two.

The social detriment due to the breeding of the feeble-minded of course far outweighs in importance the minor detriments due to the transmission of the slighter constitutional defects. The more extreme cases are confined in asylums, but the less marked cases are at liberty and constitute the lowest stratum in society. They have just sufficient intelligence to secure intermittent employment in the least skilled occupations, though they are in frequent need of poor law relief; they often marry improvidently and reproduce recklessly, for they have no foresight or control of their passions. They give birth to numerous illegitimate offspring, and their children inherit their defects. In former times these children, defective in nature and badly cared for, died like flies; now modern philanthropy steps in to preserve them, they increase in numbers, contaminate the race, and are a danger to future generations. Dr. Fantham relies implicitly on this point on the results of the American workers Davenport and Goddard, Estabrook and others. Whilst these results in broad outline will doubtless prove to be correct, it is fair to add that they have been severely criticised. Feeble-mindedness is not a definite thing due to a 'factor'; it is a varying grade of germ-damage the origin of which is due to definite causes which ought to be more closely investigated. It is instructive to note that Tredgold has found that feeble-mindedness in a given generation is often preceded in the parental generation by milder symptoms such as epilepsy or even merely nervous instability.

Turning now to the question of miscegenation, we find that the hybrids between two different races such as the Kaffir and the Dutch show no evidence of clear and sharp segregation such as is found when a mutation is crossed with the type. These hybrids show combinations of the qualities of the parental races in every conceivable proportion, but the attempt to analyse these qualities into factors, when pushed into details, reveals itself as impossible, as we have previously pointed out in the pages of NATURE. The qualities of races are acquisitions won in the struggle with the environment, and they constitute an epitome of the evolutionary history of the race. Dr. Fantham points out that the negro race, left to itself, shows no tendency to produce a civilisation or indeed to undergo any progressive evolution whatever: that it is deficient in foresight and providence, and exhibits lack of persistence and initiative. The negro is in fact a tropical animal, evolved amidst the teeming life of the warmer and more fertile zones of the earth's surface; clothing is a superfluity, and the means to satisfy hunger are comparatively easily procured, and his qualities correspond with this environment. The Dutch and English are offshoots of the white Nordic

[1] "Heredity in Man: Its Importance both Biologically and Educationally," and "Some Factors in Eugenics, together with Notes in some South African Cases." By Prof. H. B. Fantham, University of Witwatersrand, Johannesburg. *South African Journal of Science*, vol. 21, 1924, and vol. 22, 1925.

race, which grew up under the cloudy skies and cold raw climate of the shores of the North Sea in post-glacial times. The members of this race had to develop boldness and perseverance to survive at all, and they won their food as a result of terrific struggles with the elements, and to this struggle they owe their good and forceful qualities. Dr. Fantham points out that hybrids between the two races lose the admirable qualities of the white and yet are not controlled by the tribal conventions of the negro. Further, as children of the same family differ in the colour of their skins, the whiter consider themselves European and despise their darker brothers and sisters as negroes. Dr. Fantham traced one such hybrid family through five generations. A joint meeting of the Eugenic and Anthropological Societies of London was told last spring that miscegenation was far more widespread than one would gather from Dr. Fantham's papers, and was slowly undermining the moral stamina of the whole of the white population of South Africa. What are known as 'coloured people,' that is, hybrids of the second and third generation, are increasing in number, and the whiter individuals are intermarrying freely with the pure white population. We can only say that we trust that this view is an exaggerated one.

Dr. Fantham alludes to another matter of great importance, namely, the exhausting and weakening results of too frequent pregnancies not only on the mother but also on the children. We ourselves believe that the most fertile cause of human 'mutations' is to be found here. Dr. Fantham gives an example of the results of such pregnancies traced through three generations. In all three 'Mongolian idiots' appeared; this defect appears to be due to amniotic pressure on the developing brain.

Dr. Fantham's final conclusion is one which we can heartily endorse; it is that "the principles of animal [including human] biology put forward in simple interesting language and illustrated by living examples should form an essential short course in the curriculum of every University student as well as of every school child." This proposal has been pressed on our own Ministry of Education by the Council of the Eugenics Education Society, and when population and cognate problems in Great Britain become sufficiently acute to cause widespread discomfort, it will doubtless be given official attention. E. W. M.

Research in Illumination.

A SURVEY of the work of the Illumination Research Committee of the Department of Scientific and Industrial Research is given in a report issued recently by the Department. These investigations were also reviewed in a paper read by Mr. J. W. T. Walsh before the Illuminating Engineering Society on June 1. In the introduction to the Report the events leading to the formation of this committee are recalled, and attention is directed to the demand for information on lighting matters that has arisen since the formation of the Illuminating Engineering Society in 1909. On the Illumination Research Committee the medical and architectural professions are represented, and there are several members who are experts on illumination and also members of the Illuminating Engineering Society, the various British Engineering Standards Association committees, and other bodies concerned in research on illumination. Co-ordination of effort is thus facilitated and overlapping of work avoided.

The representation of the Medical Research Council on the committee is of special importance, as numerous problems before the committee have a physiological basis. This applies particularly to the study of 'glare,' and of the relation between intensity of illumination and speed and accuracy of fine work. Such fundamental researches necessarily require time. In connexion with the second problem, attention has first been devoted to printing as an example of 'fine work' readily adapted to investigations of relations between illumination and output. In this investigation valuable aid has been rendered by the Joint Industrial Council for the Printing Trades of the United Kingdom. The results are to be presented in a detailed report, but it appears that the relation between illumination and quality of work has been fully substantiated. This investigation will be extended to other forms of 'fine work.'

Other fundamental researches include a comprehensive record of daylight-intensities, now being made at the National Physical Laboratory, Teddington.

Among the 'special problems of urgency' may be mentioned the investigations of enamelled iron reflectors, which have contributed greatly to the framing of the recent British Engineering Standards Association's specification for reflectors used in industrial lighting. The design of picture galleries with the view of the avoidance of troublesome reflections in the glazed surfaces of pictures has also been studied. Another series of researches deals with the effect of flickering illumination on vision and the brightness of glassware used in various lighting fittings (the latter another problem with which a B.E.S.A. committee is concerned). A series of experiments is in progress with the object of studying the effect of colour and distribution on the degree of comfortable illumination required for clerical work. The systems examined include: (*a*) Semi-indirect lighting with vacuum lamps; (*b*) Semi-indirect lighting with artificial daylight (blue bulb) lamps; (*c*) Artificial window lighting with vacuum lamps; and (*d*) Artificial window lighting with artificial daylight lamps. Numerous other investigations include the examination of transmission of light through window-glass, the effect of window size and the reflecting power of walls and ceilings, the relation between glare and visibility in street lighting, and the distribution of temperature in the glass and other parts of lighting fittings.

Mr. Walsh, in the concluding portion of his paper, mentioned that these investigations would be the subject of individual reports, to be issued by the Department in the near future. At the meeting on June 1, general recognition of the importance of the work being done by the committee was expressed. Mr. C. C. Paterson (chairman of the Illumination Research Committee), in opening the discussion, alluded to the services rendered by the Illuminating Engineering Society and its hon. secretary (Mr. L. Gaster) in paving the way for the creation of the committee and initiating these researches. Sir John Herbert Parsons, who presided, emphasised the important field presented for physiological study by artificial lighting, and commended the subject to the notice of ophthalmologists. Miss Wiggins mentioned examples of the valuable aid which the committee has rendered to the British Engineering Standards Association in connexion with its various investigations. Mr. J. S. Dow, in commenting on the relation between illumination and ease of work, pointed out that discretion is necessary in attempting to derive standards on the basis of natural illumination, and suggested that investigations should be directed to the effect on vision of the differences in the spectra of artificial illuminants and daylight. Mr. W. C.

Raffé suggested various inquiries bearing on the effect of colour, and the influence of light on certain metals. Mr. A. Cunnington referred to problems arising in connexion with the passage of railway trains through short tunnels, as illustrating the liability of temporary dazzling of the eyes to cause accidents. Mr. P. J. Waldram discussed the problem of avoiding troublesome reflections in picture galleries, referring particularly to the effect of badly placed skylights.

At the end of the discussion Mr. L. Gaster explained the interlinking of the Illumination Research Committee with the various other organisations interested in research on illumination, and pointed out that the Illuminating Engineering Society is performing valuable service by acting as a 'liaison officer' and as a clearing-house for information. The recent discussion before the Society of the specifications of the various B.E.S.A. committees (see NATURE, March 13, p. 397) proved valuable in making them more widely known, and it is hoped that the discussion of this preliminary report of the Illumination Research Committee would be equally useful. It is of obvious importance that reports of such work should receive the widest publicity and should be thoroughly discussed, and he hoped that the forthcoming reports on individual researches would be likewise presented at meetings of the Society for full consideration.

Primitive Time Reckoning and the Calendar.

THE stages by which the Julian calendar as a method of time reckoning was attained are demonstrated by Dr. Martin P. Nilsson in a contribution to vol. 39, pt. 6 of *Scientia*, which surveys the various methods of measuring time employed by primitive and early peoples, and shows how the conception of a continuum in time, which is the essence of a calendar, has gradually developed.

The mind of primitive man, being essentially interested in the concrete, expresses time in terms of action, such as the time it takes to cook a bowl of rice, or the duration of a journey, the double hour of the Babylonians being an example of the latter. In the early stages certain recurrent natural phenomena are regarded, not as units of time of a certain duration, but as indications of time. The conception of continuity is absent at this stage. Thus time of day is indicated by the natural divisions—dawn, twilight, sunrise, or the position of the sun. Night is regarded as a whole. The crow of the cock is employed generally, but few make use of the stars as did the South American Indians and the Homeric Greeks. The conception of a 24 hours' day is late.

In the same way, the season of the year is indicated by natural phenomena, winter, summer, the season of snow, rain, drought. Neither the duration of the season nor, more remarkable, their number, is uniform. While we have four seasons, other peoples have two, three, five, or six. The unity of the year is established only slowly, and that empirically. As among the Banyankole, the reckoning may be from rains to rains. An agricultural people employs the agricultural operations, reckoning from sowing to harvest, the vacant period following the latter not counting.

The year is recorded and identified by some striking happening such as the "year of the meteorites." The Roman method of identifying it by the Consuls is another example.

The observation of the stars and constellations, and especially their heliacal rising, gives a more exact method of time reckoning. These observations are brought into relation with agricultural operations. This leads to the observation of the solar year, which in Egypt was fixed so far back as the prehistoric period through observation of the heliacal rising of Sirius; but the conception of units of time and time as a continuum arose from observation of the moon's phases, which gave the lunar month and the divisions of the lunar month as a record of time within the month. These months were named from the appropriate activities or natural phenomena. Owing to the disparity of the lunar month and the solar year in this luni-solar year, which was known to the Greeks, Babylonians, and Jews, it became necessary, whether the cycle consisted of 12 or 13 lunar months, to employ the principle of inter- or extra-calation, either at irregular intervals or periodically, as was done in Greece in the 7th century B.C. It was this last type of calendar which was superseded by Cæsar's reform, which based the Julian calendar solely on the solar year, recognising the impossibility of equating it with the lunar year.

The Need for Precision in Botanical Terminology.

IN his presidential address to the Linnean Society on May 27, Dr. A. B. Rendle referred to the work of the Society during the year. An interesting feature of certain of the discussions has been the tendency to get back to first principles or definitions and to discover that that which we had regarded as definite is after all vague. For example, in one of the discussions various authorities were quoted in support of different ideas as to the conception of the term carpel. Morphological terms originate in a desire to express certain conceptions, limited or general, and morphologists are apt to find themselves in the same position as the present-day systematist in typifying species. In the matter of definitions a meaning may be attached to a term which the originator never meant to convey; moreover, a vague use of terms may engender vague ideas of relationship. The advisability of the inclusion of the seed-like organs of Pteridosperms under the definition of seeds was also questioned. What is the degree of importance of the differences between the modern seed, which has priority for the use of the term, and the organ characteristic of Pteridosperms? Has the latter advanced beyond the gametophyte stage? Does the fact that postponement of embryo-formation until after the freeing of the seed occurs, for example in Cycads, meet the objection? This absence of an embryo may be called negative evidence; but is it not rather the absence of the criterion of the normal seed, which is an arrangement for the protection of the new sporophyte during a period of rest or transport? The phases in the life-history preceding and accompanying germination must have been widely different in the two great groups.

Until the Caytoniales were described we were clear as to what we understood by Angiosperms. We know nothing of the contents of the seed-like bodies in this primitive group, but we recognise the Angiosperm idea and associated with it the generally considered advanced character of wind-pollination.

Are we clear as to our ideas of what constitutes a Gymnosperm? The tendency is to include here

everything with a seed or seed-like structure which is not angiospermic; that is, everything from Pteridosperms to Conifers—an aggregate of widely differing groups. We are in danger of introducing merely a physiological or biological character into our systematics and of recognising a mixed group which is not comparable with the well-defined group of Angiosperms.

The relationship of Monocotyledons to Dicotyledons has been the subject of many discussions in recent years. Henslow derived Monocotyledons from Dicotyledons as a result of adaptation to an aquatic habit, and Miss Sargent similarly derived them, but looked to the geophytic habit for the explanation. Neither view will withstand criticism, and it is more in accordance with our present knowledge to admit that there is no evidence of the derivation of one from the other. The problem of the origin of these two great subdivisions of Angiosperms, like that of the Angiosperms themselves, and even of modern seed-plants, still awaits solution. We need more spade-work and more facts before we are able satisfactorily to solve these problems of phylogeny.

University and Educational Intelligence.

ABERDEEN.—At the summer graduation the honorary degree of LL.D. was conferred, among others, on Prof. F. W. Oliver and Prof. T. B. Wood.

The degree of D.Sc. has been conferred on J. E. Humphries for a thesis on "Studies in Phenylhydrazones."

CAMBRIDGE.—The Frank Smart Prizes for botany and zoology have been awarded to D. J. Watson, Downing College, and to H. P. Hutchinson, St. John's College, respectively. At King's College, E. T. S. Appleyard, G. P. Hudson, and J. M. Stephens have been elected to research studentships.

MANCHESTER.—On July 8, on the occasion of his retirement from the Beyer chair of zoology in the Victoria University, Prof. Sydney J. Hickson was presented with a cheque by Sir William Boyd Dawkins, on behalf of a number of his former students, colleagues, and friends. In eloquent terms Sir William Boyd Dawkins referred to Prof. Hickson's services to science, to the work which he has done for the University, and for the cause of education in natural science. A dinner has been arranged in his honour at the University Refectory on Friday, October 29, when his friends will have an opportunity of meeting him.

MR. GEORGE PATCHIN has been appointed Principal of the Sir John Cass Technical Institute in succession to Dr. C. A. Keane, who has retired.

MR. P. L. ROBINSON, lecturer in chemistry in Armstrong College, Newcastle-upon-Tyne, University of Durham, has been awarded the degree of D.Sc. in the University of Durham for a thesis entitled "A Comparison of the Atomic Weights of Silicon from Various Sources."

ON Thursday, July 8, H.R.H. The Prince of Wales visited Merchant Taylors' School to lay the foundation stone of a new science building on the north side of the School quadrangle and opposite the opening from Charterhouse Square. The Prince referred to the long and illustrious history of the School and to the great munificence of the Merchant Taylors' Company in fostering its many activities. After the ceremony, Mr. G. N. Pingriff (chief mathematical and science master), Mr. L. H. Hutton (chief modern languages master), and three senior boys were presented to the Prince. The new building will provide for a very complete extension of the science teaching. The old science block contains an exceptionally well equipped, though somewhat cramped, physics laboratory as well as a rather old-fashioned chemical laboratory and biological department. The new building will comprise, on the ground-floor, a large lecture room, a preparation room, and a laboratory workshop; on the first floor, a good laboratory for mechanics and elementary science, as well as a form-room for the 'Special' Fifth; and on the second floor, a new biological department consisting of laboratory and museum. This will enable the old building to be devoted almost exclusively to chemistry and more advanced physics, but the 'Special' Sixth form-room will remain here. Provision will be made for the projection of kinematograph films and a complete electrical installation consisting of an ordinary alternating current lighting circuit, a power circuit for heating and motors, and a 24-volt direct-current circuit for electrolytic and other work.

MANCHESTER was the earliest of the modern universities successfully to adopt the idea of residential halls, and the oldest of these, Dalton Hall, was founded by the Society of Friends in Manchester in 1876, being named after John Dalton, for forty years a prominent Manchester citizen and member of the Friends' Meeting. On July 9 a jubilee dinner was held at the Hall, at which was present a large and distinguished company. The toast of Dalton Hall was proposed by Sir William Boyd Dawkins, who paid a warm tribute to the part played by the institution in the general educational system of Manchester and the breadth of view which inspired its founders and had characterised its life. In the great work accomplished by the University, the Society of Friends has rendered inestimable service. They had introduced into Manchester a non-sectarian spirit and a sturdy uprightness the value of which was incalculable. Two old Principals of the Hall were present as well as the present Principal, Mr. G. A. Sutherland, until recently senior lecturer in physics at University College, London, all of whom replied to the toast. Reference was made to the number of eminent men of science and letters who have passed through the Hall as students. These include Prof. A. S. Eddington, Dr. G. C. Simpson, Dr. Gilbert Fowler, Prof. W. A. Bone, Prof. W. B. Anderson, Dr. Bevan Lean, Sir Michael Sadler, who resided at the Hall when on the University staff; Prof. J. F. Thorpe and Prof. Andrew Robertson, old Hall tutors; and Mr. W. H. Moberley, the Vice-Chancellor elect of the University. The Hall has now accommodation for 65 students and a staff of twelve tutors, most of whom hold or have held appointments on the University staff.

THE Royal Commissioners for the Exhibition of 1851 have made the following appointments to Senior Studentships and Overseas Scholarships for 1926:—*Senior Studentships:* Dr. A. J. Bradley (University of Manchester—crystallography); Dr. H. J. Emeléus (Imperial College of Science and Technology—inorganic chemistry); Mr. R. G. J. Fraser (University of Aberdeen—physics and chemistry); Dr. C. W. Shoppee (University of Leeds—organic chemistry); Mr. W. L. Webster (University of Cambridge—physics). *Overseas Scholarships:* Mr. R. C. Robb (Dalhousie University, Halifax, Nova Scotia—biology); Mr. F. H. Yorston (McGill University, Montreal—organic chemistry); Mr. H. M. Cave (Queen's University, Kingston, Ontario—physics); Mr. J. R. Vickery (University of Melbourne—bio-chemistry); Mr. F. P. Bowden (University of Tasmania—physics); Mr. E. R. Roux (University of the Witwatersrand—botany); Mr. R. R. Nimmo (University of New Zealand—physics).

Contemporary Birthdays.

July 16, 1872. Capt. Roald Amundsen.
July 18, 1853. Prof. H. A. Lorentz, For. Mem. R.S.
July 21, 1873. Sir Walter Morley Fletcher, K.B.E., F.R.S.
July 21, 1873. Prof. Howard T. Barnes, F.R.S.
July 22, 1865. Sir Richard Redmayne, K.C.B.
July 24, 1856. M. Charles Émile Picard, For. Mem. R.S.
July 24, 1853. M. Henri A. Deslandres, For. Mem. R.S.
July 25, 1854. Mr. Alfred Barnard Basset, F.R.S.

Prof. LORENTZ, an alumnus of the University of Leyden, was born at Arnheim. He was elected to the chair of theoretical physics in that University in 1875, and among his former pupils was Prof. Zeeman. The Nobel prize in physics was allotted to both of them in 1902. Rumford medallist of the Royal Society in 1908, Prof. Lorentz was awarded the Copley medal in 1918. While his researches as a mathematical physicist of the first order have covered many fields of investigation, his principal work has dealt with the theory of electrons and the constitution of matter considered as an electrodynamic problem.

Sir WALTER FLETCHER, who was born at Liverpool, is a graduate of Trinity College, Cambridge. He is Secretary of the Medical Research Council.

Prof. HOWARD T. BARNES was born at Woburn, Mass., and educated at Montreal Academy and McGill University. Originally a demonstrator in the chemistry department of McGill, he became in 1908 Macdonald professor of physics there, and, soon after, director of the Physics Building. For long he was ice engineer of the Hydro-Electrical Power Commission of Ontario. Prof. Barnes invented the micro-thermometer ice preventive method. He has written many memoirs concerning ice formation, specific heats, and radioactivity.

Sir RICHARD REDMAYNE, consulting mining engineer, was born at Gateshead-upon-Tyne. Following private tuition he attended Durham College of Science, and afterwards he became a mining apprentice at Hetton Collieries. Sir Richard was H.M. Chief Inspector of Mines, 1908–20. A member of many Royal Commissions on mining operations, he has been responsible in the main for the respective official reports. Sir Richard is a chevalier of the Legion of Honour.

M. PICARD, eminent as a mathematician, was born in Paris and educated there at the École Normale Supérieure. From 1879 until 1881 he held a professorial chair in the University of Toulouse. One of the permanent secretaries of the Paris Academy of Sciences, he is a commander of the Legion of Honour. M. Picard is an honorary member of the Royal Society of Edinburgh.

M. DESLANDRES, the distinguished director of the Astronomical and Physical Observatory at Meudon, was born in Paris and educated at the École Polytechnique. An active member of the International Astronomical Union, M. Deslandres is an officer of the Legion of Honour. He has many written memoirs on general and physical astronomy.

Mr. BASSET, a Londoner, graduated at Trinity College, Cambridge, as 13th wrangler. He is the author of a treatise on physical optics, and other works.

Societies and Academies.

LONDON.

Mineralogical Society, June 15.—S. I. **Tomkeieff**: On some chloritic minerals associated with the basaltic Carboniferous rocks of Derbyshire. Certain leptochlorites occurring as vesicular infillings in the Carboniferous lavas ('toadstones') of the North Derbyshire area are described. The chemical analysis of a finely spherulitic chlorite from Calton Hill places it definitely in the delessite-diabantite series. Some other chlorites from Miller's Dale are less crystalline and show a peculiar development of bacteria-like aggregates, similar to those observed in the chlorophæite of Dalmahoy Hill, near Edinburgh. All these chlorites can be compared with the chloritic palagonite occurring in the mesostasis of the non-vesicular basalt of the same lava flow, and it is suggested that both varieties of chlorite are primary, and were formed during the final stages of the solidification of the magma (autopneumatolitic).—F. L. **Stillwell**: On the nature of berthierite. A chemical analysis of berthierite from Nullamanna, near Inverell, New South Wales, gave the formula $3FeS . 4Sb_2S_3$. Microscopical examination of polished and etched sections of the material shows an intergrowth of about 18 per cent. of stibnite. Deducting this from the results of the chemical analysis, the formula of berthierite becomes $FeS . Sb_2S_3$.—L. J. **Spencer**: A sperrylite crystal from the Transvaal. Crystals of sperrylite (the rare platinum arsenide, $PtAs_2$) up to half-an inch across have recently been found in the Potgietersrust platinum fields, Transvaal. The crystal examined measures 5·0-5·5 mm. across and weighs 1·294 gm. It is a brilliant cubo-octahedron developed on all sides and with the corners and edges much rounded. The rounded areas give a profusion of scattered reflected images, few of which lie in the principal zones on the crystal. The only forms identified with certainty are (100), (111), (110), (210), (211).—H. E. **Buckley**: The anomalous optical properties of some new series of isomorphous double tartrates. In addition to the mixed crystals $\{m$ NaK, n Na$(NH_4)\}$ $C_4H_4O_6 . 4H_2O$, previously examined, optical anomalies of the same kind have now been determined for the series $\{m$ KNa, n K$(NH_4)\}$ $C_4H_4O_6 . 4H_2O$ and $\{m$ (NH_4)Na, n (NH_4)K$\}$ $C_4H_4O_6 . 4H_2O$. All these crystals are orthorhombic and isomorphous, but when freshly prepared they show crossed dispersion characteristic of monoclinic crystals (borax type). On standing, the crystals show a slow change in the size of the optic axial angles and in the position of the optic axial planes for different colours; and finally, after a lapse of some time, they settle down with all the optic axial planes lying in the plane (100) or (010) or in both, giving in the latter case crossed axial-plane dispersion of the orthorhombic (brookite) type. This change is hastened by rise in temperature and retarded by pressure. Sections from the outer and inner portions of the crystals showed a difference, evidently due to the time taken for growth; but in the final state they are identical, suggesting that the crystals are homogeneous. Other isomorphous series of mixed crystals containing only two of the three bases, namely $\{m$ Na_2, n Na$(NH_4)\}$, $\{m$ $(NH_4)_2$, n (NH_4)Na$\}$, $\{m$ Na_2, n NaK$\}$, and $\{m$ K_2, n KNa$\}$, showed, in the range of the visible spectrum, the optic axial planes all in one plane, but with wide differences in optic axial angle.—G. T. **Prior**: On the South African meteorites, Vaalbult, Witklip, and Queen's Mercy. The Vaalbult meteoric iron is a very deeply and broadly pitted mass weighing about

26 lb. which was found on a farm in the Prieska Division, Cape Province. It is a coarse octahedrite having a percentage of nickel of about 7. The Witklip meteoric stone fell on May 26, 1918, at about 9.40 A.M., after the appearance of a luminous meteor and loud explosions, on the farm Witklip in the Carolina District, Transvaal. Fragments weighing together only about 22 gm. appear to have been preserved. It is a grey chondrite closely resembling the Cronstad meteoric stone. Of the Queen's Mercy meteorite a large stone, a foot and a half long, fell, on April 30, 1925, at Queen's Mercy, about twenty miles from Matatiele, and was broken into small pieces by the natives. A second complete smaller stone, weighing about 950 gm., which fell about fifteen miles from Matatiele, was obtained from Chief Jeremiah Moshesh and is now in the Natal Museum at Pietermaritzburg. The meteorite is a veined grey bronzite-chondrite containing about 15·5 per cent. of nickel-iron, in which the ratio of iron to nickel is about 10·5, and about 5·5 per cent. troilite, and having a ratio of magnesia to ferrous oxide in the pyroxene of about 5.

Royal Meteorological Society, June 16.—J. E. **Clark**, I. D. **Margary** and R. **Marshall**: Report on the phenological observations in the British Isles, 1925. This year illustrated strikingly how easily extreme conditions may cancel out each other if the year is taken as a whole. December 1924 and November 1925 stand out, one as the mildest for many years, the other among the coldest. May gave extremes of warmth and cold and was very wet. June drought and heat were extreme. Yet the year was exactly normal in temperature, and so too the mean date of flowering. Migrants were only a day late. The tree fruit was doubly hit. Early blooming after the warm winter exposed it to the inclemency of late April and May, while the June drought was fatal to young fruit set badly, and also to later-sown crops. Hay, early sown grain, roots including potatoes, did pretty well where weather permitted fair harvesting, but sunshine after mid-July was lacking. Normal plant progress was uneven in various districts, lines of equal unseasonableness showing some districts very early, others as much late. The spread over the British Isles of the cuckoo compared to the swallow shows that passing westward to Ireland from S.E. England its lag behind increases from two to ten days. But northwards to Berwick it loses only three days and then begins to catch up, finally reaching north Scotland a day early on the average of thirty-five years. Twelve organisations are now collaborating in Europe, extending north to Scandinavia, south to Italy, and east to Russia.—S. Morris **Bower**: Report on winter thunderstorms in the British Islands, Jan. 1 to Mar. 31, 1925. February was the stormiest month in England and Wales, while January was most disturbed in Scotland and Ireland. For England and Wales the stormiest areas were mainly on or near the south coast, the southern parts of Sussex and Surrey being heavily visited.—Edward **Kidson**: Abnormal rates of ascent of pilot balloons in the lower levels of the atmosphere at Melbourne. Observations extending from 1922 until 1925 are discussed, and tables given showing respectively (1) rapid ascending currents in the atmosphere, and (2) low rates of ascent. Rapid ascending currents and low rates of ascent most frequently occur in the months of September to February inclusive, that is, in the months when the land is warmer than the air and sea. The rapid ascending currents are encountered with the greatest relative frequency at 11.00 hr. and the least at 9.30 hr. With the low rates of ascent the greatest and least relative frequencies are at the same hours. The low rates of ascent seem to be largely the product of turbulence, the balloon being caught in the ascending portions of eddy currents.

Royal Anthropological Institute, June 22.—V. Gordon **Childe**: The first colonisation of Central Europe. The first food-producing civilisation was introduced into Belgium and northern France through the gradual spread of Danubian cultivators. These may be traced back to Moravia, and it is clear that in their migration they lost elements of culture. The origin of their civilisation must be sought farther south, immediately in 'Hungary,' though not on the Danube-Tisza plain, which in the warm, wet, early neolithic period would have been uninhabitable. On the loess terraces of Serbia and the Banat a rich civilisation has been discovered from which the Moravian might be derived by degradation. The sites are located where open ridges of loess are cut by the Danube or the Tizsa, just where people coming up the Danube would be likely to halt, and often in the vicinity of ores or on auriferous streams. The remains, notably remarkable clay statuettes, and the costume these illustrate, suggest that their makers came up the river bringing with them elements of Ægean and Egyptian civilisation. In the formation of Danubian civilisation, survivals of palæolithic elements and influences from the vase-painters of Transylvania can be detected, and its spread may ultimately have been accelerated by the pressure of nomadic steppe-folk from south Russia.

PARIS.

Academy of Sciences, June 7.—L. **Lecornu**: The problem of the grindstone.—Léon **Guillet**: The tempering of lead-antimony, lead-tin, and lead-antimony-tin alloys. Referring to the recent work of Dean, Zicheick and Nix on the tempering properties of white-metal alloys, the author directs attention to earlier work by Dubosc and by himself on the same subject.—Léon **Guillet**: The cementation of copper, nickel and their alloys by tin. The cementation was produced by heating with a bronze powder (tin 25 per cent.), and results are given for copper, nickel and some alloys. The thickness of the cementation layer varied considerably, 1 mm. being the maximum. The object of the work was to produce a surface with low friction with the minimum proportion of tin.—Victor **Grignard** was elected a non-resident member in succession to the late W. Kilian.—Michel **Petrovitch**: A remarkable property of a series of double integrals.—A. **Véronnet**: Extension of the vectorial calculus to analysis and to the absolute differential calculus.— — **Noaillon**: The determination without ambiguity of the solution of the problem of Dirichlet for functions capable of summation.—Mlle. N. **Bary** and D. **Menchoff**: The integral of Lebesgue-Stieltjes and absolutely continuous functions of absolutely continuous functions.—Henry **Bénard**: The frequency laws of detached alternating vortices behind an obstacle.—P. **Dumanois**: The possibility of realising high compressions without antidetonants. By a modification of the shape of the piston of an internal combustion engine it has proved possible to obtain the same results as were obtained by the introduction of lead tetraethyl into the petrol. The comparisons were made in a car on the road.—Th. de **Donder**: The application of relativity to atomic and molecular systems.—R. **Chambaud**: A particular class of solutions of the problem of the circular ring. Application to the theory of thick circular arches.—M. **Samsoen**: The expansion of commercial glasses. Seventeen kinds

of glass were prepared, cast into rods, and the coefficients of expansion measured with the Chevenard differential dilatometer. The complexity of the problem prevents any theoretical conclusions being safely drawn from the data obtained. It was found, however, that the additive rule of Winkelmann and Schott is not valid.—Salomon **Rosenblum**: α-rays with single charge.— — **Chevenard**: The course of the isotherms representing the resistance and thermo-electric power of the reversible ferro-nickels in the interval −200° C. to 1000° C. The experimental results, shown in diagram form, do not clearly indicate the existence of the compound Fe_2Ni, but are not definitely opposed to the possibility of its existence. Further experiments at temperatures between −195° C. and the absolute zero are required.—T. **Karantassis**: Double decompositions between the halogenides of phosphorus, tin, arsenic, antimony, lead, bismuth, silicon, titanium, zirconium and thorium. From the experiments described the conclusion is drawn that in the trivalent metalloid group the iodide of an element of low atomic weight exchanges its iodine for chlorine or bromine from the halogenide of an element of higher atomic weight.—N. **Maxim**: The action of the organo-magnesium compounds on some aromatic dialkylamides.—Em. de **Martonne**: Dryness and the index of aridity.—**Jacquet**: New radioactive springs in the Puy-de-Dôme.—L. **Eblé**: Magnetic measurements in the north-east of France.—Aug. **Chevalier**: The cinchonas of tropical Africa.—Mlle. G. **Bonne**: The constitution of the gynæceum in the Chrysobalaneæ.—X. **Chahovitch**: The energy metabolism in the course of experimental scurvy. Study of the metabolic quotient. It is suggested that the increase in the basic metabolism in experimental scurvy may be due to increased secretions of the suprarenal capsules and of the thyroid gland.—Mme. L. **Randoin** and R. **Lecoq**: The inequality of the proportion of water-soluble vitamins (B) in yeast extracts of different origin. It is generally accepted that yeasts and yeast extracts are substances exceptionally rich in the water soluble vitamins. Experiments on pigeons are described which prove that all yeast extracts have not the same biological value. An extract from beer yeast appeared to contain two factors, one securing the maintenance of the animal, the other essentially curative as regards polyneuritis. On the other hand, an extract of distillery yeast contained only the first factor and, tested biologically, was markedly inferior to the extract of beer yeast.—Claude **Fromageot**: The oxidation of pyruvic acid by ceric ions. On oxidation of pyruvic acid with ceric salts the solution containing the enol form behaved differently from that containing the keto form, the former taking up more oxygen. The enol form is more rapidly oxidised than the keto form.—Raymond **Petit**: The action of a solution of basic chlorhydrate of quinine and of urethane on the blood.—Henri **Marcelet**: Studies of the oils extracted from the head of a dolphin (*Delphinus Delphis*). Oils extracted from the maxillary glands, from the nose, and from the fat surrounding the skull were submitted to complete physical and chemical examination. Large differences were observed, showing that earlier analyses of oil described as dolphin head oil must give misleading figures.—H. **Barthelemy**: The influence of the dilution of the sperm on the duration of survival of the spermatozoids of *Rana fusca* in aqueous or saline media.—Ch. **Porcher**: The alteration of the micelles of the caseinate in the calcium caseinate—calcium phosphate complex and its consequences in the action of rennet on this complex.— — **Boulard**: A method permitting fermentations to be arrested at will, especially liquids containing sugar and alcohol, and rendering these unfermentable. The method is based on the fact that a second culture does not develop in a medium which has previously served for the cultivation of the same ferment. The method is capable of industrial applications.—E. **Lesné** and S. **Simon**: New observations on the anti-rickets factor of cod-liver oil. Vegetable oils neither prevent nor cure experimental rickets, whereas certain cod-liver oils both prevent and cure. It is shown that whilst certain oils are more or less active, others are absolutely inert, even although the latter fulfil all the requirements of the Codex. It is suggested that these results prove the necessity for a biological test of cod-liver oil.—A. **Nanta**: A myxobacterial splenomegaly.—P. E. **Pinoy**: A syn-bacterium isolated from cases of splenomegaly.

ROME.

Royal National Academy of the Lincei, May 2.—P. **Burgatti**: Elastic distortions.—U. **Cisotti**: Dynamic effects of a fluid circulating between any number of thin cylinders with parallel axes.—Ferruccio **Zambonini** and Luca **Coniglio**: The presence of marked proportions of cæsium compounds in certain products of the present-day activity of Vesuvius.—M. **Cantone**: Reply to a criticism. Bemporad's criticism of the author's communication on a new method of studying experimental results.—Achille **Russo**: Absence of agamous period and individual development in *Cryptochilum echini* Maupas.—Luigi **Fantappié**: Non-linear analytical functionals.—Francesco **Tricomi**: Inversion formula of the order of two double integrals "with asterisk."—Vladimiro **Bernstein**: Singularity of interpolar functions satisfying certain asymptotic conditions.—E. **Cartan**: Riemann's spaces in which transport by parallelism maintains the curvature.—G. **Vranceanu**: A class of anolonomous systems.—U. **Bordoni**: The transmission of heat by radiation.—E. **Persico**: Magnetic rotatory polarisation in an alternating field. The rotatory polarisation of light in an alternating magnetic field follows the variations in the field almost exactly.—Giorgio **Piccardi**: The affinity of the neutral bromine atom for the electron.

VIENNA.

Academy of Sciences, May 20.—F. **Schuster**: On vapour pressure curves.—A. **Wegener**: Observations ot the twilight arch and of the zodiacal light in Greenland.—Z. **Dische** and D. **Lazlo**: The influence of carcinoma on the glycolysis of organs, especially liver and kidney.—F. **Heritsch**: The "window" of Fischbach, a vault of Semmering rocks, limestone and quartzite under the massive gneiss.—H. **Handel-Mazzetti**: New Chinese plants (fortieth and last communication), including 12 species of Gentiana.

Official Publications Received.

Conseil Permanent International pour l'Exploration de la Mer. Rapports et Procès-verbaux des Réunions, Vol. 39: Report of the North-Western Area Committee for 1924 and 1925 (Rapport Atlantique, Secteur Nord-Ouest, 1924-1925). By Prof. Johs. Schmidt. Pp. 168. Publications de Circonstance, No. 91: On a New Repeating Current-Meter. By V. Walfrid Ekman. Pp. 27. (Copenhague: Andr. Fred. Høst et fils.)

Transactions of the Royal Society of Edinburgh. Vol. 54, Part 3, No. 11: The Anatomy of the Head of a Fœtal African Elephant, Elephas africanus (Loxodonta africana). By Dr. Nellie B. Eales. Pp. 491-551+12 plates. 12s. Vol. 54, Part 3, No. 12: The Old Red Sandstone of Shetland. Part 1: South-Eastern Area. By Dr. T. M. Finlay; with an Account of the Fossil Fishes of the Old Red Sandstone of the Shetland Islands, by Sir Arthur Smith Woodward and Errol Ivor White. Pp. 553-572+3 plates. 3s. 6d. (Edinburgh: Robert Grant and Son; London: Williams and Norgate, Ltd.)

Department of the Interior: Bureau of Education. Bulletin, 1926, No. 3: Recent Progress in Legal Education. By Alfred Z. Reed. Pp. 30. (Washington, D.C.: Government Printing Office.) 5 cents.

Berichte der Naturforschenden Gesellschaft zu Freiburg i. Br. Herausgegeben von Prof. Dr. J. L. Wilser. Sechsundzwanzigster Band, Erstes Heft. Pp. 120+46. (Freiburg i. Br.: Speyer und Kaerner.)

Empire Cotton Growing Corporation. Report of the Fifth Annual General Meeting. Pp. 12. (London: Millbank House, Millbank, S.W.1.)

Proceedings of the South London Entomological and Natural History Society, 1925-26. Pp. xviii+112+9 plates. (London: Hibernia Chambers, London Bridge, S.E.1.)

Cardiganshire Antiquarian Society. Transactions, Vol. 4. Pp. 95. (Aberystwyth.)

Proceedings of the Academy of Natural Sciences of Philadelphia, Vol. 78. Veronicellidae from British Guiana, by H. Burrington Baker; Anatomical Notes on American Helicinidae, by H. Burrington Baker. Pp. 29-56. Some additional Faunal Remains from the Trias of York County, Pennsylvania. By H. E. Wanner. Pp. 21-28. (Philadelphia, Pa.)

Memoirs of the Department of Agriculture in India. Chemical Series, Vol. 8, No. 8: Drainage Waters at Cawnpore. By H. N. Batham. Pp. 127-152. 10 annas; 1s. Entomological Series, Vol. 9, No. 4: The Red Pumpkin Beetle, Aulacophora abdominalis, Fb., and its Control; with a Short Note on A. atripennis, Fb. By Mohammad Afzal Husain and Syed Abdullah Shah. Pp. 31-57+plates 12-14. 1 rupee; 1s. 9d. (Calcutta: Government of India Central Publication Branch.)

City of Norwich. The Report of the Castle Museum Committee to the Council, 1925. Pp. 25. (Norwich.)

Catalogue of Products illustrating the Tardenoisian and other Microlithic Industries exhibited at the Rooms of the Royal Anthropological Institute of Great Britain and Ireland, 52 Upper Bedford Place, June 8th to June 22nd, 1926. Pp. 8. (London.) 9d.

Empire Cotton Growing Corporation. Report on the Cotton-growing Industry of Nigeria, 1926. By Col. C. N. French. Pp. 48. (London: Millbank House, Millbank, S.W.1.) 2s.

Smithsonian Institution: the National Gallery of Art. Catalogue of Collections, II. By William H. Holmes. Pp. vi+118+45 plates. (Washington, D.C.: Government Printing Office.) 1.65 dollars.

Smithsonian Institution: United States National Museum. Bulletin 131: The Minerals of Idaho. By Earl V. Shannon. Pp. vii+484. (Washington, D.C.: Government Printing Office.) 75 cents.

Smithsonian Miscellaneous Collections. Vol. 77, No. 11: Music of the Tule Indians of Panama. By Frances Densmore. (Publication 2864.) Pp. 39+5 plates. Vol. 78, No. 1: Explorations and Field-Work of the Smithsonian Institution in 1925. (Publication 2865.) Pp. iii+132. (Washington, D.C.: Smithsonian Institution.)

United States Department of Agriculture. Department Circular No. 363: The Japanese Beetle. By Loren B. Smith and Charles H. Hadley. Pp. 66. 25 cents. Department Circular No. 380: Calcium Cyanide as a Fumigant for Ornamental Greenhouse Plants. By C. A. Weigel. Pp. 16. 5 cents. Farmers' Bulletin No. 1461: The Common Cabbage Worm and its Control. By F. H. Chittenden. Pp. ii+14. 5 cents. Farmers Bulletin No. 1462: The Potato Leafhopper and How to Control it. By J. E. Dudley, Jr. Pp. ii+12. 5 cents. Farmers' Bulletin No. 1472: Preventing Damage by Termites or White Ants. By T. E. Snyder. Pp. ii+22. 5 cents. Department Bulletin No. 1364: Effects on Honeybees of Spraying Fruit Trees with Arsenicals. By N. E. McIndoo and G. S. Demuth. Pp. 32. 5 cents. Department Bulletin No. 1369: The Cattle Grubs or Ox Warbles, their Biologies and Suggestions for Control. By F. C. Bishopp, E. W. Laake and H. M. Brundrett, and R. W. Wells. Pp. 119. 25 cents. (Washington, D.C.: Government Printing Office.)

Diary of Societies.

SATURDAY, JULY 17.

SOCIETY FOR EXPERIMENTAL BIOLOGY (in Department of Natural History, University of Edinburgh), at 10 A.M.—Dr. F. A. E. Crew: The Developmental Capon and Poulard.—E. A. Spaul: The Metamorphic Principle of the Anterior Lobe of the Pituitary.—W. P. Kennedy: Diet and Reproduction in the Rat.—Prof. J. H. Priestley: The Perception and Transmission of Stimulus in the Coleoptile of the Grass Seedling.—L. A. Harvey: The Relation of Cell Inclusions to Cell Metabolism.

MONDAY, JULY 19.

SOCIETY FOR EXPERIMENTAL BIOLOGY (at the Botanical Gardens, Edinburgh), at 10 A.M.—J. Gray: The Growth of Fish.—E. Philip Smith: The Effect of Acidity on Regeneration in Coleus.—J. W. Gregor: The Influence of Environment on the Formation of definite Habitat Types.—K. B. Blackburn: Some Observations on Sex and Chromosomes in Plants.—(In Department of Natural History, University of Edinburgh), at 2.30.—A. Walton: The Survival of Fertilising Capacity of Rabbit Spermatozoa *in vitro*.—A. D. Hobson: The Formation of the Fertilisation Membrane in *Echinus esculentus*.—E. Ponder: The Kinetics of Hæmolytic and Bacteriolytic Reactions.—T. Rettie: Demonstration of a Histological Method for the Early Stages of Cell Injury.

WEDNESDAY, JULY 21.

CORRELATIVE SCIENCE SOCIETY (at Royal Botanic Society of London, Regent's Park), at 3.—Waves and Vibrations—The Spectra of Nebulæ, of Temporary, Variable and Normal Stars.

CONFERENCES.

JULY 15 TO 19.

JOURNÉES MÉDICALES DE PARIS (at Paris).

JULY 19 TO 23.

BRITISH MEDICAL ASSOCIATION (at Nottingham).

SOCIETY OF CHEMICAL INDUSTRY (Annual Meeting) and CONGRESS OF CHEMISTS.

Monday, July 19.—Institution of Chemical Engineers (Annual Corporate Meeting) (at Central Hall, Westminster), at 10 A.M.—Sir Frederic L. Nathan: Industrial Efficiency and the Elimination of Waste (Presidential Address).—At 11.30 A.M.—Exhibition of Chemical Plant (at Central Hall, Westminster).—At 2.30.—(At Mansion House).—Presentation of the Society's Messel Medal to the Earl of Balfour, and Delivery of the Messel Memorial Lecture by Lord Balfour.

Tuesday, July 20.—Society of Chemical Industry (Annual Meeting) (at Hotel Great Central), at 10 A.M.—W. J. U. Woolcock: Presidential Address.—Joint Meeting of the British Chemical Plant Manufacturers' Association, the Institute of Metals, the Institution of Chemical Engineers, and the Chemical Engineering Group for a Symposium on 'Corrosion' (at Hotel Great Central), at 10.30 A.M.—Ulick R. Evans: Fundamental Principles of Corrosion.—Dr. W. H. Hatfield: Chemically Resistant Steels for Chemical Engineering.—P. Parrish: Corrosion and Erosion.—T. G. Elliot and G. B. Willey: Chemically Resistant Steels, with special reference to Very High and Very Low Temperatures.—Joint Meeting of the Bio-Chemical Society with the London Section of the Society of Chemical Industry (at Hotel Great Central), at 11 A.M.—The Scientific and Industrial Problems presented by the Hormones—the Natural Drugs of the Body:—Dr. H. H. Dale: The Experimental Study and Use of Hormones.—Dr. H. W. Dudley: The Chemistry of the Pituitary Gland and of Insulin.—F. H. Carr: The Commercial Production of Hormones.—Dr. H. A. D. Jowett: The History of Adrenalin.—Prof. G. Barger: Recent Progress in the Chemistry of Thyroxine.—Dr. J. W. Trevan: Biological Assay of Hormones.—British Chemical Plant Manufacturers' Association (Annual Meeting) (at 166 Piccadilly), at 2.30.—British Association of Chemists (at Hotel Great Central), at 3.—Dr. Stephen Miall and others: Discussion on Chemistry House.

Wednesday, July 21.—Society of Chemical Industry (Annual Meeting) (at Hotel Great Central), at 10.30 A.M.—Addresses by Sir Josiah Stamp and Sir Max Muspratt, Bart.

Thursday, July 22.—Society of Chemical Industry (Annual Meeting) (at Hotel Great Central), at 10.30 A.M.—Joint Meeting arranged by the Chemical Engineering Group with the Institution of Petroleum Technologists, and the Institution of Chemical Engineers on Power Alcohol.—Dr. W. R. Ormandy: Sugar from Wood.—D. Ross and Dr. W. R. Ormandy: Experiences with Alcohol Motor Fuels.—Joint Meeting of the Institution of the Rubber Industry and the Oil and Colour Chemists' Association (at Hotel Great Central), at 10.30 A.M.—Discussion on The Influence of Particle Size in the Paint and Rubber Industries:—Dr. D. F. Twiss: The Importance of Particle Properties in the Rubber Industry.—G. A. Klein: The Importance of Particle Properties in the Paint Industry.—Dr. S. S. Pickles: Carbon Black.—H. Green: The Necessity for a Direct Measurement of Particle Size.—B. D. Porritt and G. Gallie: An Apparatus for the Estimation of Grit in Pigments.—E. A. Murphy: The Detection of Grit in Rubber Compounding Ingredients.—A. de Waele: The Different Types of Dispersion and some Factors Determining Same.—Dr. P. Schidrowitz: Note on the Influence of Particle Shape.—N. Heaton: The Influence and Elimination of Coarse Particles.

Friday, July 23.—Institution of Chemical Engineers and the Oil and Colour Chemists' Association (at Hotel Great Central), at 10.30 A.M.—L. J. Simon and Prof. J. W. Hinchley: Discussion on Fat Extraction by Solvents.—Fuel Section (at Hotel Great Central), at 10.30 A.M.—Dr. E. W. Smith: Summary of the Symposia at Leeds and Sheffield on Solid Smokeless Fuel.

JULY 22 TO 28.

INTERNATIONAL CONGRESS ON ALCOHOLISM (at Dorpat).

JULY 26 TO 31.

FRENCH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE (at Lyons).

AUGUST 3 TO 6.

INTERNATIONAL PHYSIOLOGICAL CONGRESS (at Stockholm).

AUGUST 16 TO 23.

INTERNATIONAL BOTANICAL CONGRESS (at Cornell University).

AUGUST 23 TO 28.

AUSTRALASIAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE (at Perth, Western Australia).—Prof. E. H. Rennie: The Chemical Exploitation, Past, Present and Future, of Australian Plants (Presidential Address).—The Presidents of Sections and the Titles of their Addresses are as follow: *A* (*Astronomy, Mathematics and Physics*), Prof. K. Grant, Atomic Transformation; *B* (*Chemistry*), Prof. J. Kenner, Some Aspects of the Problem of Molecular Structure; *B* 2 (*Pharmacy*), A. T. S. Sissons, The Indebtedness of Pharmacy to Organic Chemistry; *C* (*Geology and Mineralogy*), Sir Douglas Mawson, The Igneous Rocks of South Australia—a brief Survey of Present Knowledge relating thereto; *D* (*Zoology*), Prof. L. Harrison, The Composition and Origins of the Australian Fauna, with special reference to the Wegener Hypothesis; *E* (*Geography and History*), Prof. E. Scott, The Discoveries of the Western Australian Coast, with especial reference to Dampier and D'Entrecasteaux; *F* (*Ethnology and Anthropology*), Prof. F. Wood Jones, The Claims of the Australian Aboriginal; *G* (*Social and Statistical Science*), Major L. F. Giblin, Federation and Finance—an Examination of the Financial Relations of States to a Federal Commonwealth; *H* (*Engineering and Architecture*), Sir John Sulman, Town Planning; *I* (*Sanitary Science and Hygiene*), F. S. Hone; *J* (*Mental Science and Education*), P. Board, Social and Economic Values in Education; *K* (*Agriculture and Forestry*), C. E. Lane Poole, Forestry and Land Settlement; *L* (*Veterinary Science*), Prof. J. D. Stewart, The Relationship of Veterinary Science to the Prosperity of the State; *M* (*Botany*), Prof. A. J. Ewart, Past and Future Development of Botanical Science; *N* (*Physiology and Experimental Biology*), Prof. W. A. Osborne, The Study of the Reflex.

AUGUST 26.

MEDICAL WOMEN'S INTERNATIONAL ASSOCIATION (at Prague): Discussions on Tuberculosis and Pregnancy; Women Police-surgeons.