



SATURDAY, MAY 17, 1930.

CONTENTS.

	PAGE
The Rules of Zoological Nomenclature	733
International Trade. By W. G. Linn Cass	735
Preservation of Scenery in the Thames Valley. By Dr. Vaughan Cornish	737
Fossil Brains. By P. J. van der Feen, Jr.	738
Our Bookshelf	739
Letters to the Editor :	
Reflection of Positive Ions by Crystals.—Prof. A. J. Dempster	741
A Point in the Theory of 'Critical Illumination' in the Microscope. Dr. L. C. Martin	741
Atmospheric Light Columns from Artificial Lights.—A. H. R. Goldie ; Dr. F. J. W. Whipple	743
Telosynapsis or Structural Hybridity in <i>Enothera</i> ? C. D. Darlington	743
The Integuments of Whales.—Robert W. Gray	744
Search for an Inactive Isotope of the Element 84 (Polonium).—Prof. G. Hevesy and A. Guenther	744
The Oldest Record of a Slug.—Prof. T. D. A. Cockerell	745
Polarisierte und gerichtete Röntgenstrahlung aus einem Kristall.—Prof. J. Stark	745
The Ancestry of Man.—Prof. Henry Fairfield Osborn, For. Mem., R.S.	745
Scattering of X-rays by bound Electrons.—Prof. B. B. Ray	746
The Identity of Colloidal Particles in Soap Sols and Gels.—Dr. K. Krishnamurti	746
Intensities in Band Spectra.—Elmer Hutchisson	746
The New Planet.—G. F. Daniell	747
Angler-Fishes. By Dr. C. Tate Regan, F.R.S.	747
The Geological History of the Pacific Ocean. By Prof. J. W. Gregory, F.R.S.	750
News and Views	752
Our Astronomical Column	757
Research Items	758
The <i>Snellius</i> Expedition. By Commander P. M. Van Riel	761
Optical Rotatory Power. By Prof. T. M. Lowry, F.R.S.	762
Archæology and Bible History	764
University and Educational Intelligence	764
Historic Natural Events	765
Societies and Academies	765
Official Publications Received	767
Diary of Societies	768

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. 3159, VOL. 125]

The Rules of Zoological Nomenclature.

AS already announced in NATURE, the International Zoological Congress will meet at Padua next September. A week before the Congress opens, the International Commission on Zoological Nomenclature will resume its sittings so as to report to the Congress on numerous cases that have been submitted for its opinion and on certain important proposals that have been under consideration since the last Congress. It is useful to remember that this Commission has carried on its work continuously since its appointment in 1895. Even during the War its members were in correspondence, and, though a longer interval than usual elapsed between the Congresses, there was no break of any kind. The composition of the Commission of eighteen members has continued subject to the bye-laws, according to which members are elected for a term of nine years and one-third retire triennially. Thus the wisdom of experience is seasoned with new ideas. Criticism has been levelled at the constitution of the Commission, but it is difficult to devise any better method. Great care is taken that the various branches of systematic zoology and the different parts of the world should be represented. A commissioner must be interested in the subject and must have access to a good library, but no attempt is made to seek out the holders of particular opinions.

However such an international body be appointed, and with whatever care it weighs the arguments, its decisions cannot please everybody. It would be absurd to suppose that all zoologists could agree on these disputed questions. Inevitably also there is perennial conflict between the general zoologist and the specialist, between the morphologist and the systematist. It seems obvious that the decision must rest with those who are constantly dealing with names and have studied the principles of nomenclature ; but since the Congress at Monaco the Commission has accepted fairly the compromise there agreed upon, by which the rules may be suspended when their rigid application would lead to worse confusion.

At Budapest, in 1927, the Commission spent several days in attempting to meet the views of many critics. No final decision was reached, but certain amendments were suggested in the Commission by way of compromise, and they have to be finally voted on at Padua. An account of these and other proposals of later date was recently given by the Secretary of the Commission, Prof. C. W. Stiles, to the International Congress of

Entomology, and is published in its *Transactions* (4, pp. 622-645). Some of them may be mentioned here.

At an early date the Congress refused to receive from the Commission any amendments to the rules that had not received a unanimous vote in Commission. Of recent years the view has gained ground, particularly in Europe, that this permitted an obstinate minority (possibly of one) to bar generally desired reforms, and it has been proposed that any amendments which obtain a majority vote in Commission should be reported to the Congress and decided by it in open meeting. This plainly goes too far in the other direction and it is not surprising that the Commission has rejected it twice. It is, however, to come up again, and a compromise has been proposed, as follows :

“ At least all those proposals for amendments to or additions to the International Rules of Zoological Nomenclature which have obtained—*first*, a majority of five-sixths of the total membership of the Commission of Nomenclature for the time being, and *subsequently*, five-sixths of the votes of those present at the meeting of the Commission, shall be the recommendations of the Commission to the Congress.”

This has been countered by a proposition that “ The stability of the rules is a prime and fundamental principle ”. Theoretically, most workers will accept this, for constant revision of the rules would be disastrous. It is further argued that rules based on a unanimous vote should not be altered except by unanimous vote. The practical question seems to be whether a rule which experience has shown to be objectionable should be modified soon or at a later date. No doubt impracticable or unwise proposals will be made from time to time, but it is highly improbable that they would ever gain the votes of five-sixths of the Commission. On the other hand, it does seem probable that any proposal supported outside the Commission by a large body of working zoologists and inside it by fifteen of its eighteen members would some day gain the suffrages of all the Commissioners. Is anything gained by postponing that day ?

Other proposals that fall to be discussed this year concern type-designation by elimination, the acceptance of generic names used by non-binominal authors, and the change of starting-point from Linnæus’ “ *Systema Naturæ* ”, Ed. X. to Ed. XII. This last would, if accepted, throw an enormous amount of work accomplished during the past thirty years on to the scrap-heap ; but its acceptance is in the highest degree unlikely.

It is a somewhat curious fact that on all these questions except the last there is an apparent cleavage of opinion between American and European zoologists. If one could discover the true reasons for this divergence, one would probably arrive at the best solution of the matters in dispute. Some will tell us that the American pack merely comes to heel at the call of Prof. Stiles, an absurdity that carries its own refutation to anyone acquainted with American conditions. Perhaps one reason is to be found in the mentality that leads citizens of the United States to organise their activities, whether of business or sport, on lines of mechanical thoroughness manifest in such apparatus as rationalisation, classifications, card-indexes, and rules. The Englishman, if not the European at large, prefers freedom to over-much legislation. He is quite as law-abiding as any American, and has indeed so high a respect for the law that he will not pass laws unlikely to be obeyed and is ready to reform those that prove harmful.

Prof. Stiles maintains that, because eighteen (or fewer) people have once unanimously agreed on a rule, that rule should never be altered except by unanimous vote. At the outset unanimity was forced on the Commission by the Congress, and it looks as though the Commissioners were consequently more unanimous in their votes than they were in their opinions, for the sake of getting something done. Anyone with experience of committees knows how often practical considerations lead him to vote for a proposition with which he does not fully agree. If now there is a real demand by zoologists that the power of veto resident in any single commissioner should be taken away, and a five-sixths effective majority substituted, is there any good reason why the Commission should not accept this and thus conciliate the opposition ? The further reason given by Prof. Stiles is that the rules should be stable in principle and that any reversal would be disastrous. With this thesis most zoologists will doubtless agree, though there might not be such general agreement on what is a principle and what is not, and some might claim that a non-retroactive change is not a reversal. However that may be, it appears highly improbable that when rules have been maintained for thirty years on a unanimous basis, any serious alterations will win the votes of five-sixths of the Commission. Important as the stability of the rules doubtless is, it is no less important that they should be generally accepted and applied. The Commissioners may be so immovable that the flood of zoologists will pass them by.

International Trade.

Unsolved Problems: National and International.

By John S. Hecht. Pp. 288. (London: Jarrolds Publishers (London), Ltd., 1930.) 16s. net.

ON April 25, 1835, the Académie des sciences morales et politiques—one of the five academies comprising the Institut de France in Paris—announced a prize competition, and offered the sum of 3000 francs for the best essay in answer to the following question:

“When a nation intends to establish free trade (la liberté du commerce), or to modify its tariff laws, what are the facts which it ought to take into consideration in order to reconcile in the most equitable manner the interests of producers and of consumers?”

Among the competitors was a German engineer, Friedrich List, whose name is among the greatest in the annals of economics, and who, after devouring all the works on political economy he could find in the great Paris bibliothèque, wrote out his essay in feverish haste, working day and night. The result was an elaborate treatise on economics which, although it did not win the prize—the prize was not, in fact, won by anybody—formed the basis of his subsequent work on a national system of political economy.

The prize was not won, and now after nearly a hundred years it seems that the world still awaits a satisfactory solution of the above problem, although it is now stated in a rather more comprehensive form, and with less emphasis on the distinction between producers and consumers. It is a problem which, in so far as its solution appeared to lie in the direction of free trade, has always profoundly interested the scientific world; for, justly or unjustly, the doctrine of free trade has always appeared to have a sounder scientific foundation than any sort of protectionist theories which, on the contrary, appeared to rest on a merely empirical basis, grounded in expediency, self-interest, and sheer opportunism. Free trade seemed also to have an even higher and nobler origin in or association with that philosophy of freedom and liberty which shone so clearly and strongly in eighteenth century thought, and it is no wonder that it appealed powerfully to both philosopher and scientific worker, and that the most learned body in Europe, nearly a hundred years ago, deemed it not beneath its most serious consideration; but some shadow of doubt is now emerging whether free trade really deserves this rich cloak of aristocratic association whilst protectionism shivers in the rags of em-

piricism. In the most authoritative work yet published on the history of economic doctrines (that of Profs. Gide and Rist) it is stated that

“If there is one lesson more than another that emerges from a study of the history of economic doctrines it is the necessity for a more critical spirit and a more watchful attitude, always ready to test any new truths that present themselves, to extend a hearty welcome to every fresh observation or new experience, thus enabling the science to enlarge its scope and gain a deeper significance without sacrificing any of its essential tenets.”

One presumes, in passing, that the only real test of new truth is practical experiment, even in the social sciences, that indeed a vast amount of experimentation in the social sphere has been an outstanding feature of the last twenty or thirty years, that such experiment should be continued and extended and the results collected and collated with the utmost possible diligence and mental acumen, and that all real or imaginary association with worn-out theories or philosophy should be broken.

This and the above quotation may be said to form the basis of Mr. Hecht's new book, which may be strongly recommended for close study by everyone interested in commercial and industrial problems; and who to-day is not interested? He says that our chief problems nowadays are naturally of an economic order, and the most pressing of them, because inability to solve it calls for doles with their demoralising influence, is unemployment. There is not enough work to go round, which seems strange when one considers that out of every hundred individuals the material desires of ninety-nine are unsatisfied. Then there are the correlated problems concerning agricultural and industrial depression, the insufficiency of the national dividend and consequent burden of taxation, and the restriction of credit. Further, what is the reaction of foreign commerce on the aforesaid problems? Some think that their solution and the prevention of ill-will among nations lies in freer trade and buying in the cheapest market. Others are equally convinced that for Great Britain the right policy is safeguarding and buying within the Empire. Can these things be put to the test of practical experiment, or must they for ever form the burden of endless argument and exacerbated controversy? Mr. Hecht considers that the pivot of all these problems, both national and international, is wages, and it is mainly from the point of view of wages that he seeks, and claims to have found, a solution both of the wages problem or just distribution of wealth, and of the safeguarding problem and abatement of

international discord. The French Academy offered a prize of 3000 francs. The British nation might well offer a prize of £3,000,000 to anyone finding a satisfactory and practical solution of these weighty and hitherto intractable enigmas.

There is not space here to do justice to Mr. Hecht's discussion of the wages problem in the first part of his book, and we must confine our attention to a brief examination of the second part, treating of international trade, with special reference to free trade and safeguarding. He at least has no respect for free trade because of its affected association with an old and worn-out philosophy or pretence at scientific form. It does not indeed exist in real life, and is a mere abstraction. In regard to Great Britain it would be quite justifiable to say that, so far from being scientific, it is not even correct in its name, and surely it is hopelessly unscientific to make a serious mistake right at the outset in terminology. Trade consists in exports as well as imports, and whilst the British export trade is hampered and shackled and overwhelmingly burdened with high tariffs in nearly every market in the world, it cannot, except by a most ridiculous distortion of the truth, be called in any sense of the word free. A system merely of free imports is vastly different from free trade as understood by its greatest exponent, Adam Smith; and to seek to uphold such a one-sided system under a false name is not science and is morally indefensible.

Mr. Hecht insists on the profoundly important distinction between complementary imports and competitive imports. Forty or fifty years ago the imports into Great Britain were mainly complementary and consisted in those things, largely raw material, which we could not produce ourselves at home. But as other nations became more advanced and industrialised the character of our foreign trade underwent a radical change, and our imports became largely competitive. Mr. Hecht shows that complementary imports decrease production costs and raise wages by economising labour, and by keeping labour and capital employed in those industries where both profits and wages are high. He shows further, or certainly makes out a strong case for the contention, that competitive imports on the contrary increase production costs by reducing the efficiency of home industries and the possibility of mass production. Moreover, the cost of producing anything depends on another factor, namely, the continuity of demand, or in other words an assured and adequate home market. "To expect industrial enterprise," says Mr. Hecht, "if an article is to be

made at home one day and imported on the morrow is absurd." But foreign competition in the home market is always variable: in the absence of tariffs one can be sure that it will be intense, but the degree of intensity cannot be predicted. For the same reason the export markets are generally unstable, and little planning ahead for future demand—so essential for minimum costs—is possible. Therefore we may conclude that competitive imports involve the loss of what would be a certain and stable home market for what is necessarily an uncertain and unstable foreign market.

"Competitive imports destroy the stability of home industries, and cause thereby a twofold increase in production costs. For, first, although these imports must be paid for by exports, industrial or commercial instability makes capital unproductive by leaving it standing idle; secondly, industrial or commercial instability makes labour unproductive by provoking unemployment." (See Chaps. v. and vi. in the original.)

The author next proceeds to examine a further disastrous effect of unrestricted competitive imports, namely, that of lowering the quality of home industries. It is fairly well known by every British manufacturer that the keenest competition from abroad is in those industries where profits and/or wages are high, and where there is the maximum scope for price-cutting. The ultimate effect of foreign competition, that is, competitive imports, is to drive labour and capital from those higher grade industries into those of lower grade where both profits and wages are lower. This degradation in British industry has been going on constantly for the last thirty or forty years, so that to-day the leading industries are low grade wherein profits are almost negligible and wages down to a minimum, for example, in coal-mining, in many branches of the textile industries, in shipping, and in several others.

Britain's three principal exports—coal, textiles, shipping (this latter paying for imports by services)—are low grade in the sense that both wages and profits are very low, whereas German and American exports are the products of high grade industry. This is well illustrated by the character of the trade in textiles between Germany and Great Britain in 1913. In that year Great Britain exported to Germany hosiery, lace, cotton gloves, and other highly finished textiles to the value of only £633,776, whereas her imports from Germany in the same class of goods were £4,328,185. Of cotton waste and yarn (low grade semi-manufactured textiles), British exports to Germany amounted to £5,662,872,

and her imports from Germany £443,028. This was in 1913, and the position from the British point of view has become much worse since then. It shows clearly that Germany is getting more and more of the trade in the higher class highly finished textiles and leaving the lower grade branches, of low wages and lower profits, to Great Britain. This change in the *quality* of British industry and British exports is one of the most momentous in the industrial history of the country, and is not sufficiently appreciated in all its implications.

A further charge in the indictment of our so-called 'free trade', more correctly free or competitive imports, is contained in its effect on agriculture. Mr. Hecht very truly says that home-grown food is our natural food; imported food cannot be so fresh and is liable to deterioration, so that the health and productive power of a people dependent mainly on imported food must suffer. Also the import of agricultural produce drives labour from the village into the town. "But agriculture is undoubtedly the healthiest industry known to man. It breeds a virile race. Consequently, competitive imports increase production costs by impairing the salubrity of home industries." It may be that Mr. Hecht is not on quite such sure ground here as in other parts of his indictment; but he does make out a strong case for his main contention, that is, that competitive imports lower wages in home industries, and that universal free trade would reduce wages throughout the world, down indeed to the level of the lowest paid labour, such as that of India, China, or Japan.

In a chapter showing how the current theory of international trade came to be tolerated, the author comes to the conclusion that that theory is well-nigh inexplicable in all its various postulates, including the assumptions that all imports economise labour, that the amount of labour economised is incalculable, that money pays for imports. That theory has indeed originated in the same false principles as the current theory of wages, and he quotes Sir William Ashley ("A Retrospect of Free Trade Doctrine") at great length in support of his denunciation thereof. The last two chapters in an excellent work, which should be closely studied by everybody, deal with the influence of money on international trade, and with the safeguarding problem. In his examination of an exceedingly intricate, difficult, and highly contentious field the author has endeavoured to keep as closely as possible to the actual facts of our present industrial position, and shows, moreover, a fairly comprehensive grasp

of the voluminous literature of the subject dealt with, as evidenced by the exhaustive documentation which supports the book. It is an invaluable contribution to the elucidation of the vital problems which now seem to involve the very existence of the British nation.

W. G. LINN CASS.

Preservation of Scenery in the Thames Valley.

The Thames Valley from Cricklade to Staines: a Survey of its Existing State and some Suggestions for its Future Preservation. Prepared by the Earl of Mayo, S. D. Adshead, and Patrick Abercrombie, with the assistance of W. Harding Thompson, for the Thames Valley Branch of the Council for the Preservation of Rural England. Pp. xvi + 106 + 34 plates + 6 maps. (London: University of London Press, Ltd., 1929.) Limp cloth, 15s. net; cloth boards, 21s. net.

THE publication of this handsome quarto volume with fine type and good paper, admirably illustrated and well provided with specially prepared maps, will serve to mark an epoch in the history of landscape planning. Before the Industrial Revolution, the wealthy landowner planned the environment of his mansion so that garden, open pasture of the park, woodland, and arable, combined economic efficiency with pictorial grouping. The time has now come when the nation should take control of the countryside and plan its development so as to combine the conditions of economy and beauty.

The charms of the Thames-side between Cricklade and Staines are described by the authors of this book with a restrained enthusiasm in keeping with the quiet beauty of the country itself, thus predisposing the reader to a sympathetic consideration of the constructive proposals for preservation of beauty under progressive conditions. The riverside towns are dealt with in succession, particular attention being given to by-pass roads and other means for preserving the charms of the old High Street; and the use and preservation of every ancient bridge is carefully considered. The excellent photographs of these monuments remind us of the fact that in the shadowing of its arches an outdoor viaduct excels the beauty of nave or aisle; and that the arches which span a smooth stream excel those of the viaduct because of their etherealised reflection.

The most important, and perhaps the most novel, proposals are those relating to the prevention of building on the broad, flat meadows

which lie in the embrace of the river's curve. To the unwary visitor, these appear attractive for residence, or at the least for the week-end bungalow, but are in fact unfitted for any dwelling-place. The ground is always waterlogged at a level little below the surface and is in most cases liable to flood, so that the site is unhealthy for the occupant. A still more important drawback is the difficulty of providing for disposal of sewage and of preventing contamination of the river. It is needful, moreover, that the river should be allowed to spread over these meadows in seasons of heavy rain, thus preventing sudden and excessive rise of level in the lower reaches.

When we turn from the hygienic to the æsthetic aspect of the matter we find that it is a requirement of scenic grouping, or 'landscape composition', to keep these broad, flat meadows free from buildings, for they are the foil of riverside towns and wooded bluffs, and also essential to the prospect from the opposite, higher bank, from which we obtain the wider view of the Thames Valley and its background of distant hills.

The Council for the Preservation of Rural England has only been in existence for three years, but its influence upon public opinion is already so great that there is every reason to hope that the proposals put forward on behalf of its Thames Valley branch will receive careful and sympathetic consideration.

VAUGHAN CORNISH.

Fossil Brains.

Die fossilen Gehirne. Von Tilly Edinger. Pp. 249. (Berlin: Julius Springer, 1929.) 36 gold marks.

THE best results in science have been obtained mostly by combining two hitherto separate branches or methods. The author of the work before us is a daughter of the late Prof. Ludwig Edinger, who is well known as one of the founders of the comparative anatomy of the brain. She grew up, therefore, in a very centre of comparative neurology, and having also studied palæontology from the geological point of view, she joined these two branches in a remarkable manner in *palæoneurology*, which is not an entirely new combination, but has never been practised so thoroughly and methodically. The chance to make errors in this field is greater than anywhere else. For, as the author acknowledges in the very beginning of her book, a fossil thigh-bone is a thigh-bone anyhow, but a 'fossil brain' is not a brain at all: it is—with a few exceptions—only a natural (petrified) or artificial endocranial cast of a fossil skull. By

this fact we know more of the central nervous system of many fossil animals than, for example, of their intestines, but to interpret the data with accuracy we must begin by studying in recent animals the relations between the brain and the form of the endocranial cavity, which is in many cases much more spacious than would be necessary to contain the brain only. These and other methodical and technical matters are discussed in detail and elucidated with many illustrations in the general part (pp. 9-100) of the book.

Dr. Edinger has tried to write a clear and instructive book for neurologists, for whom so many names of geological periods and fossil animals are mere 'words', as well as for palæontologists not versed in the neurological 'jargon'; and in this she has been successful.

The other part of the book is a copiously illustrated critical compilation (classified according to the zoological system) of all that is known about the central nervous system of fossil vertebrates; and it is more than a compilation only, for the author, guided by her great experience on the subject, often gives her own interpretation of the facts. The alphabetical bibliography (250 entries!) has the practical feature that not only are the titles cited, but also with every article a brief mention is made of what it contains referring to the subject in question.

In conclusion, some of the problems of general interest dealt with in the chapters may be mentioned. Marsh's 'law' suggesting that the species that proved to be the 'fittest to survive' had comparatively larger brains than the extinct forms, is not generally confirmed. Technical masterpieces of palæoneurology are the reconstructions of the endocranial cavity with all canals and openings in fossil fishes, made by Stensiö. It is confirmed that some of the giant forms among fossil animals had small brains, but a relatively giant hypophysis. The sacral dilatation of the spinal canal in *Stegosaurus* is discussed in detail. The brain of the flying reptiles (Rhamporhynchoidea and Pterodactyloidea) had many bird-like features, while the brain of the contemporary *Archæopteryx* was still more of the reptile type. The typical form of the bird's brain seems to be in connexion with the function of flying. Like other organs also, the fossil brains make it clear that both birds and mammals have developed gradually from reptiles; this evolution is partly a relative increase of the fore-brain. The brains of fossil Anthropeidea are described in a special chapter.

P. J. VAN DER FEEN, JR.

Our Bookshelf.

Reports of the Progress of Applied Chemistry. Issued by the Society of Chemical Industry. Vol. 14, 1929. Pp. 775. (London: Society of Chemical Industry, 1930.) 7s. 6d. to Members, 12s. 6d. to non-Members.

THE publication of a new volume of the annual reports of the progress of applied chemistry recalls the strange fact that there are still some industrial chemists who have never used, never even heard of, this excellent review. Chemists are usually busy people, and busy people cannot be expected to read extensively the literature of those parts of the science with which they are not immediately concerned. They ought to do so, they admit, but can find neither time nor capacity for the enormous task. Nowadays, a chemist who claims to be well informed is not necessarily a voracious reader of original papers, even in his own language, but is often one who, at least for his non-essential study, relies on records such as that under review, afterwards using them for the selection of the relevant literature to be consulted. How often do we now read not to acquire information but to discover where it is to be found! Moreover, only the favoured few can afford to maintain a reasonably adequate chemical library; most of us are content, so far as journals are concerned, to keep the annual reports on pure and applied chemistry at hand and the corresponding abstracts within reach. By so doing we can at least rely on being kept in close touch with the development and application of chemical science.

The present volume covers the same ground as its immediate predecessor with the exception of explosives, in which domain the survey is biennial. The chapters on general, plant, and machinery (R. Edgeworth-Johnstone); fuel (J. G. King); refractories, ceramics, and cements (W. C. Hancock); iron and steel (C. O. Bannister); india-rubber (H. P. Stevens and W. H. Stevens); leather and glue (D. Woodroffe); foods (L. H. Lampitt); sanitation and water purification (J. H. Coste); fine chemicals, medicinal substances, and essential oils (E. Stedman); and photographic materials and processes (F. M. Hamer) have been entrusted to authors who were not concerned in the preparation of last year's report; the remainder of the twenty-four chapters have been contributed by the same authors as in 1929, either alone or in collaboration.

A. A. E.

Laboratory Guide to Vertebrate Dissection: for Students of Anatomy. By Dr. A. B. Appleton. Pp. xix + 152. (Cambridge: At the University Press, 1929.) 6s. net.

As its title indicates, this is a book for use in a practical comparative anatomy course. It is intended for a somewhat unusual class of student, and consequently its contents, outlook, and method of treatment are unlike those of the standard texts in this subject. As stated in the preface, it is assumed that the student has already done a course in elementary zoology, including the usual verte-

brate types, and has also examined in more detail a mammal. Unless this mammal were man, a number of comparisons in the book would be missed. To obtain full benefit from it the student should obviously have taken the preliminary medical studies, including a fair amount of human anatomy. This is not meant to imply that the student of advanced zoology cannot get many useful hints and fresh points of view from its pages; he undoubtedly can. The types, treated in a series of regional dissections, are the lamprey, the dogfish (*Squalus*), *Necturus*, the lizard, and the dog. As it is intended for assistance in dissection, information regarding osteology and the details of the central nervous system have been purposely omitted and, conversely, the muscles are treated somewhat more fully than is customary.

In applying, so far as possible, the International (Basel *Nomina Anatomica*) Code of Nomenclature, the author has set a commendable example that might be followed with advantage by other works in comparative anatomy. On p. 28 it is stated that from the union of the pre- and post-trematic arteries dorsal of the first gill-cleft two vessels arise: "the first efferent branchial artery and the internal carotid artery (lateral dorsal aorta)". The former is better termed the first epibranchial and the latter is the hyoidean epibranchial—it is certainly not the internal carotid or the lateral dorsal aorta, as a glance at Scammon's reconstruction of these vessels in the embryo would show.

Atmospheric Corrosion of Metals: Third (Experimental) Report to the Atmospheric Corrosion Research Committee (British Non-Ferrous Metals Research Association). A Discussion held by the Faraday Society, 23rd May 1929. Pp. 173-252 + 475-502. (London: The Faraday Society, 1929.) 5s. 6d. net.

PREVIOUS reports to the Atmospheric Corrosion Committee have been concerned with laboratory experiments, and most interesting results have been obtained regarding the part played by an initial film of tarnish in determining the subsequent course of corrosion, especially of copper and its alloys. In the present state of our knowledge of corrosion, such carefully designed and executed experiments are of far greater value than a mere accumulation of empirical data, the number of which is already far too great. It was necessary, however, to confirm the laboratory results by field tests, and the latest report describes a systematic series of such tests, utilising the conclusions of the earlier work.

As is usual in field tests of corrosion, the results are by no means simple, and in fact the total amount of corrosion was so small as to suggest that typical non-ferrous metals should last for very long periods, even in industrial atmospheres. Much depends on the amount of exposure to rain, as the corrosion when the soluble products are continually removed may take a quite different course from that taken when the products accumulate as a crust. For wire specimens, the change of electrical resistance gives a fair measure of the

extent of the corrosion. The effect of humidity and of the formation of deliquescent products is clearly brought out, and the results are of undoubted value. In practice, local attack due to the concentration of the effects on a small portion of the exposed surface must play a large part in determining the life of a material, general corrosion having little effect.

La diffusion moléculaire de la lumière. Par Jean Cabannes, avec la collaboration d'Yves Rocard. (Recueil des Conférences-Rapports de Documentation sur la Physique, Vol. 16.) Pp. viii + 326. (Paris: Les Presses Universitaires de France, 1929.) 65 francs.

THE scattering of light by small particles observed by Tyndall was studied exhaustively by Lord Rayleigh, who showed in 1871 that each particle, assuming its dimensions small in comparison with the wave-length, sets up a secondary disturbance which travels in all directions. In 1899, Rayleigh concluded that the blue colour of the sky could be accounted for by the scattering of light by molecules of the atmosphere. In the book under notice, the author seeks to establish a coherent theory of the diffusion of light in the interior of a fluid on the assumption that the incident wave excites in each molecule a movement proportional to the field; these little induced doublets vibrate with the frequency of the exciting wave and in their turn radiate diffused light.

Although the idea of such molecular diffusion is comparatively modern, we are confronted to-day with an immense field of experimental and theoretical investigation. The author has accordingly confined his attention almost entirely to the diffusion of ordinary light in the interior of pure transparent fluids, and only in an appendix does he refer to the Raman effect. He has carried out a critical examination of the experimental results and also of the theoretical formulæ. In the latter part of this work he has had the assistance of M. Rocard, who contributes two chapters dealing with the character of the diffused light as the critical point is approached, and with the study of the 'critical opalescence'. The volume should be of great service to future investigators.

Discoveries and Inventions of the Twentieth Century. By Edward Cressy. Third edition, revised and enlarged. Pp. xxi + 476 + 177 plates. (London: George Routledge and Sons, Ltd.; New York: E. P. Dutton and Co., 1930.) 12s. 6d. net.

As the successor to Routledge's "Discoveries and Inventions of the Nineteenth Century", Mr. Cressy's book has enjoyed considerable popularity. First published in 1914, a second edition appeared in 1922, and to this further matter has now been added, and the number of illustrations has been increased. No one, perhaps, realises the difficulty of attempting to deal with modern discoveries and inventions in one volume, or of keeping such a volume up-to-date, more than the author himself.

Mr. Cressy's book is written in the first place for the non-technical reader, but we imagine many

engaged in scientific work and engineering will find its chapters of great interest. The ground covered is mainly that of power generation and transmission; transport by land and sea and air; communication by electricity, and such developments of chemistry and physics as may be included under the titles—soils and crops; the borderland of modern chemistry; applications of photography; radium, electricity, and matter. Other subjects to which chapters are devoted are the electric furnace and refrigeration.

Included in the text are many diagrams and photographs, the former being by far the more valuable to those wishing to know the why and wherefore. Whether the non-technical reader can understand the principle of the gyroscopic compass or the Ljungström steam turbine from the drawings given we are doubtful. In the chapter on gas, petrol and oil engines, the Fullagar engine is unfortunately shown upside down, while the statement that the internal combustion engine used in ships is not reversible needs correcting.

The Conduction of Electricity through Gases. By Dr. K. G. Emeléus. (Methuen's Monographs on Physical Subjects.) Pp. x + 94. (London: Methuen and Co., Ltd., 1929.) 2s. 6d. net.

THE phenomena of the electric discharge in gases are very striking in character and appeal strongly to those interested in physics. Besides, they have received numerous technical applications. But the subject is in reality complicated from an experimental point of view and is one which from a theoretical point of view is incompletely understood. The nature of the discharge is due to the occurrence of many elementary processes (the most important of which are ion formation and the excitation of light) linked together in a way which is obscure. Dr. Emeléus has presented fairly the present stage of development of the subject, and, therefore, we welcome his little work even though we may regret that he has not had more space to develop his views; for then the book would have been more readable as well as more informative. But in compensation it is very cheap, and since, within its limits, it is extremely well written, we have no hesitation in recommending it.

H. W. B. SKINNER.

The National Benzole Association. Standard Specifications for Benzole and Allied Products, 1929. Pp. xiii + 145. (London: National Benzole Association, 1929.) 6s. net.

MULTIPLICITY of standard processes has been avoided by the whole-hearted adoption by the National Benzole Association of those portions of the "Standard Methods for Testing Tar and its Products" (see NATURE, April 26, p. 631) appropriate to the examination of benzene, toluene, xylene, and naphtha. In addition, there are given for various commercial grades of these materials, fourteen specifications, applicable only when the particular methods described are used. Allowance is made for the addition of any further specifications or methods that may be made from time to time.

B. A. E.

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.]

Reflection of Positive Ions by Crystals.

FURTHER experiments on the reflection of hydrogen positive rays from crystals, similar to those described in NATURE for Jan. 11, have shown that the phenomenon is more complex than might have been expected. More than a hundred photographs showing reflected rays have been obtained under various conditions, and they show several features of interest. Great differences have been found in the reflecting powers of different samples of calcite. Two were found that gave strong reflected rays when the glancing angle was less than two degrees. The images obtained on Schumann plates placed at right angles to the beam may be properly termed reflection patterns, as they show considerable complexity, vary in a regular manner with the angle of incidence, and can be reproduced at will with the same setting of the crystal and speed of the rays. Six other calcite crystals gave reflection patterns containing fewer lines or lines on a fogged background. Reflected rays were also observed with a diamond which was kindly loaned by Dr. D. Cooksey. A natural cleavage face of this diamond had been used in experiments on the reflection of gamma rays. A highly polished face gave indistinct patterns on a fogged background. Clear lines were obtained from two other faces, one of which was the natural cleavage face, and the other a face that had been cut and appeared rough, due to saw marks. No reflected rays were found in a few trials with rock salt, galena, and magnetite.

The strongest parts of the patterns are produced by rays that have energies corresponding to more than six thousand volts. Slower rays may be present in the original bundle, as shown by a positive ray analysis, but they are not reflected so strongly as the faster rays. With a low potential on the discharge tube the reflection pattern lacks certain of the parts that appear with high potentials. A positive ray analysis of the ions reflected from one of the calcite crystals showed that in addition to the hydrogen atoms previously reported, all the positive ions in the original bundle are present in the reflection patterns, namely, hydrogen molecules, triatomic hydrogen molecules, and heavier ions that are probably oxygen atoms. With the present resolution, the various ions are superimposed in the streaks or lines formed by the reflected rays of various velocities.

The dependence of the angle of deviation by the crystal on the energy of an ion, rules out the possibility of ascribing the reflection to the deviation of particles by electrostatic forces, which would require the reflected rays of various velocities to lie in a plane, and to have angles of deviation inversely proportional to the energies of the particles. In most cases the reflected rays of different velocities do not lie in planes, as they give curved images on the plate, and in the cases where a straight line is formed the deviation is not inversely proportional to the energy but is a linear function of the reciprocal of the velocity. Charges would not be expected to accumulate on the crystal because of the secondary electrons liberated by the bombardment of metal parts near it, and its uncharged condition is shown by the fact that those rays which just pass over the crystal without hitting it are undeflected. The small penetration

of the ions into matter, as compared with electrons of the same equivalent wave-length, suggests that energy changes at the surface or inside the crystal will have to be taken into account in a complete theory. The important factor in determining the angles may be a quantity analogous to a refractive index which would depend on the energy of the ion and its alterations.

Small changes in the angle at which the incident rays hit the crystal produce a regular series of changes in the direction of the deflected rays. At nearly grazing incidence on one of the calcite crystals, with the rays parallel to an edge of the cleavage rhomb, there was a fan-shaped arrangement of the reflected rays in eight or more radial lines of different intensities. As the angle was made steeper, the lines formed by the reflected rays of various velocities shifted towards the normal to the crystal surface, and became curved, the intensities altered, and new curved lines appeared at the sides, making the patterns more complex and more symmetrical. This change was produced by an increase of only one degree. With a second calcite crystal which was turned so that, at grazing incidence, the rays made an angle of about fifteen degrees with an edge of the cleavage rhomb, clear patterns were obtained which had an unsymmetrical character. These patterns, as well as those from the diamond, also changed in a regular manner with small increases in the angle of incidence. The dependence of the angles of reflection on the angle of incidence and on the velocity of the rays suggests very strongly that a theory of the phenomenon will have to contain other elements besides particles and the forces exerted on them by electric and magnetic fields.

A. J. DEMPSTER.

University of Chicago, April 22.

A Point in the Theory of 'Critical Illumination' in the Microscope.

It is extremely difficult to give any general theory of the formation of the image in the microscope, inasmuch as the action differs with every different object and with the arrangement of the illumination. On the other hand, it is possible to give a satisfactory account of particular cases which throw light on the various 'simplifications' which have from time to time been put forward. Modern views are represented in a recent discussion on the Abbe theory (*Jour. Royal Mic. Soc.*, 49, pp. 123-142 and 228-264; 1929).

A case which allows of simple treatment is that in which the illuminating system is imagined to be projecting the image of an axial point source symmetrically into the object plane. It may be assumed that the illuminating lens is free from aberration and that it has a rectangular aperture.

The distribution of amplitude in the plane then follows the usual law

$$a = \text{constant} \times \frac{\sin u}{u},$$

which is plotted in the thick curve of Fig. 1. Note that the amplitude may change sign, but the phase remains constant. The broken curve shows the relative intensity, represented by the square of the above function. As is well known, the central maximum is very large in comparison with the lateral maxima, which rapidly decrease in intensity. Similar results are found for the distribution of amplitude and intensity along the diameter of the 'Airy disc' characteristic of a circular aperture.

If A_1 is the 'numerical aperture' of the illuminating

cone, the distance h between the central maximum and the first dark minimum ($u = \pi$) is given by

$$h = \frac{0.5\lambda}{A_i}$$

We may select a case where a grating, typified by a row of very small apertures, lies symmetrically in the

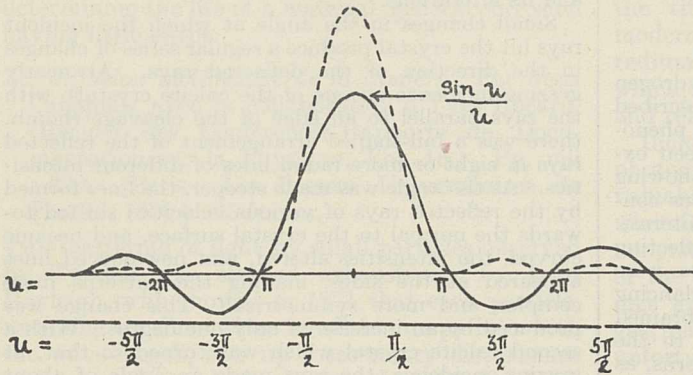


FIG. 1.—Values of $(\sin u)/u$, full curve, and $(\sin u)^2/u^2$, broken curve.

object plane. Then, selecting the spacing of these apertures as distant from the axis on each side by the intervals corresponding to

$$u = \pi/2, \quad 3\pi/2, \quad 5\pi/2, \text{ etc.},$$

it will appear that the amplitudes of the portions of the illuminating interference pattern exposed by the apertures are proportional to

$$2/\pi, \quad -2/3\pi, \quad 2/5\pi, \text{ etc.},$$

on each side.

Consider now the central pair of apertures. If each aperture is very small, the amplitude of the vibrations diffracted into various directions by one aperture will be fairly uniform. The amplitude effect of the two in a direction taken in an axial plane containing the row of apertures and at an angle θ with the normal to the 'grating' will be

$$\text{amp.} = 2a_1 \cos \frac{\pi x \sin \theta}{\lambda},$$

where a_1 is the amplitude due to one acting singly, and x is the spacing.

$$\text{The effect of the second pair is } 2a_2 \cos \frac{3\pi x \sin \theta}{\lambda}.$$

Thus the series representing the effect of the whole row becomes one of the type

$$f(\phi) = \frac{4}{\pi} \left(\cos \phi - \frac{\cos 3\phi}{3} + \frac{\cos 5\phi}{5}, \text{ etc. } \dots \right),$$

which is at once recognised as the Fourier expansion of 'unity'.

The resultant effect of the series is seen in the distribution of amplitude in the back focal surface of the objective of the microscope, which follows the Fourier graph, Fig. 2, in which the amplitude changes suddenly from plus one to minus one at the values of ϕ given by $-\pi/2, \pi/2, 3\pi/2, \text{ etc.}$ The sharpness of the transition is determined by the number of terms in the series, in our case by the number of lines in the grating free to transmit light; not by the number which are visibly illuminated.

The regions of constant amplitude with their sharp boundaries correspond to the (touching) diffraction 'images', of the condenser pupil formed by the objective, and if the light is unrestricted, the full resolving power, proportional to the number of elements, is thus seen to be valid although only one or two of

the central elements are illuminated in any marked relative intensity.

I have chosen one of the simplest possible cases to deal with above, but the discussion can be extended to the more general cases of gratings disposed unsymmetrically to the illuminating 'pattern', and hence to gratings with finite apertures. In all cases which I

have examined so far, the sharply bounded diffraction images appear. Therefore the idea underlying the so-called critical illumination of the microscopist, that is, that the sharply focused condenser or illuminator destroys the effective coherence relations between the different parts of the object plane, is somewhat fallacious. Of course the extension to the practical case involves the illumination by a source of finite area, and an indefinite number of overlapping Airy discs appear in the object plane, so that the discussion of the above type of coherence can often be short-circuited (as can be shown in certain cases) in favour of a shortened 'equivalence principle'. However, the fundamental features of the optical action in such cases is very generally misunderstood, and

many physicists have maintained that the resolving power of the grating would be greatly diminished in such a case as the above in spite of Huygens' principle. Whereas the usual 'Abbe theory' contemplates phase relations only between sets of homologous points or lines, the actual process involves phase relations over definite areas. The discussion of the consequences of these ideas is outside the scope of a short letter.

In order to test these conclusions practically, I have removed the eyepiece of a spectrometer and mounted a piece of process screen with about 200 lines to the

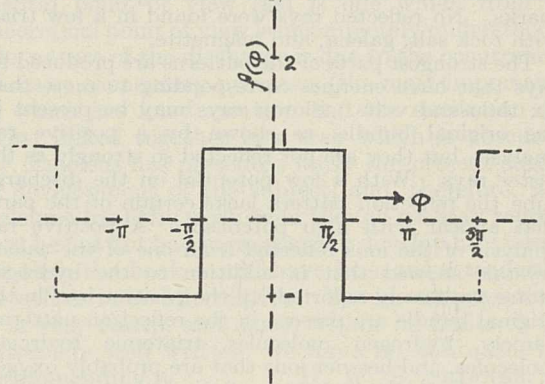


FIG. 2.—Fourier expansion of unity (cosine series).

inch in the plane of the spectrum, so that the lines of the grating are parallel to the monochromatic slit image, which is carefully focused in the 'grating'. It is not difficult to ensure that not more than one grating element is appreciably illuminated. In spite of this the grating is found to produce sharp diffraction images of the aperture of the telescope objective of the instrument. An interesting variation is to use the whole spectrum so that every element is apparently illuminated by a different wave-length. The diffraction, of course, persists.

In view of the importance of such considerations in the theory of the microscope, I hope to discuss them more fully elsewhere, and I may add that Mr. G. F. Rose has performed a number of very interesting experiments confirming the principle, which he will also describe.

L. C. MARTIN.

Imperial College of Science and Technology,
South Kensington, S.W.7, Mar. 28.

Atmospheric Light Columns from Artificial Lights.

The light columns observed by Mr. Currie (NATURE, April 5, p. 526), though rather unusual phenomena, have been described previously. Once in France and twice in Italy, during the War, I noticed that gun flashes at distances of the order of 15 kilometres appeared as narrow vertical streaks of light centred about 10° - 15° above the horizon. The occasion in France (Nov. 6, 1916) was a most striking one; a note giving the details was published after the War in the *Quar. Jour. Roy. Met. Soc.*, 45, pp. 366-368 (1919). About 9.30 P.M. on that evening there were visible, in addition, parts of a lunar halo of 22° , a horizontal circle or mock moon ring, and a halo of 90° . During the remainder of the evening continual gun flashes produced a weird and unnatural effect as of vertical slits opening and closing suddenly in a dark curtain with a fiery background. Later in the same evening a still more remarkable spectacle was presented in that, as a result of enemy action, a large ammunition depot, some 15 km. distant from the point where I was stationed, was set on fire. The fire (or fires) appeared also as great vertical streaks in the sky, with a dark patch at their centre, the altitude of this dark centre, measured by theodolite, being $32\frac{1}{2}^{\circ}$.

The meteorological situation at the time was that northern France lay under the warm front of an advancing depression, and the sky by this time (11 P.M.) was overcast with thin alto-stratus cloud, deteriorating, through which the moon still shone dimly. The optical phenomena produced on this evening by the coincidence of a modern bombardment and a great ammunition fire with the peculiar meteorological and optical situation which produces mock moons, etc., have possibly seldom been equalled in history. Even in less sensational form, the phenomenon of vertical light columns from artificial lights is apparently seldom seen in western Europe; at least, even knowing of its existence, I have not often seen it.

Again, Prof. Carl Störmer states (in *Geof. Pub.*, vol. 4, No. 7, pp. 57-58) that he saw "a singular atmospheric optical phenomenon", near Oslo on Feb. 5, 1922, when spectroscopic examination enabled a column of red light to be distinguished as not being an auroral ray. It was verified later that in this case the fire had been 6 km. distant. It is remarked that there was diffuse thin cloud through which one could distinguish the stars, and that this cloud must have consisted of ice crystals and have been at a height of about 3000 metres. Prof. Störmer told me recently that he has not on any other occasion seen such a phenomenon.

A. H. R. GOLDIE.

Edinburgh, April 10.

MR. HUGH NICOL's explanation (NATURE, May 3, p. 671) of atmospheric light columns from artificial lights is not merely an extension of mine but an alternative. My explanation, the orthodox one, is that the columns are due to the reflection of light from laminar crystals; his suggestion is that the columns are due to diffraction by laminar or acicular particles.

I do not think the diffraction hypothesis can be accepted. The laminar crystals which are in the majority when phenomena like sun pillars occur are not microscopic objects. The diameters of flat crystals without rays were measured by Dobrowolski. He found, for example, that at -6.3° C. the average diameter was 1.7 mm. The cloud particles which produce diffraction phenomena, coronæ, are much smaller, having diameters of the order 0.02 mm.

The most satisfactory demonstration that reflection does take place from crystals with horizontal sur-

faces comes from aeronautical observations. It sometimes happens that the aeronaut flying over a cloud sees on the cloud a white patch, the under-sun. When he comes to a break in the cloud and catches a glimpse of a sheet of calm water below, he realises that the direction of the brightest part of the under-sun is just that of the image of the sun in the water.

As we are obliged to admit the effectiveness of reflection in this case, there is no need to doubt that the same cause is operative in the other.

F. J. W. WHIPPLE.

Kew Observatory,
Richmond, Surrey,
May 6.

Telosynapsis or Structural Hybridity in *Ænothera*?

IN a recent article¹ I have put forward a hypothesis which I consider provides an explanation in terms of segmental interchange and parasynapsis of (i) the occurrence of ring-formation in *Ænothera*, (ii) its inheritance on selfing and crossing, and (iii) the occurrence of mutant forms differing in properties of ring-formation from their parents. These seem to be the essential requirements of a working hypothesis expressing the relationship of *Ænothera* with other plants and animals. Further, the premises on which the hypothesis is based have been defined very fully in later articles.^{2, 3, 4, 5}

Two of Prof. Gates's pupils, Miss Sheffield⁶ and Mr. Catcheside,⁷ have defended his earlier views and criticised this hypothesis on general grounds, without, however, providing any evidence that the hypothesis is incompatible with earlier observations. Their objections are directed against my first paper and would, I feel, be removed by a study of the theoretical principles enunciated with some precision and a great amount of detail in the later ones^{2, 3, 4, 5} which they do not quote. It seems superfluous to define these principles again, for there is little to add and nothing to take away.

Catcheside,⁷ however, has also made a new observation, namely, that a ring of 21 chromosomes is formed in a triploid plant; this he concludes "completely disposes of the hypothesis of segmental interchange, adapted (*sic*) by Darlington as a basis for parasynapsis in *Ænothera*". Mr. Catcheside has been good enough to show me his preparations. The critical structures seemed to me susceptible of being interpreted, not as a ring of 21 chromosomes, but as consisting of various configurations of the kind observed by Håkansson in his account of triploid *Ænothera*.⁸ Thus the associations I made out were the following: (i) unpaired chromosomes; (ii) rod pairs, united at one end; (iii) ring pairs, united at both ends; (iv) chains of three and of four chromosomes; (v) branched chains of chromosomes (with triple union); (vi) ring pairs associated (by a triple union) with one end of a third chromosome. Mr. Catcheside has given a formula, based on my hypothesis, with which these types agree.

In view of the difficulty of interpretation of diakinesis figures in triploid *Ænothera* (cf. Catcheside's figures 35 and 36), I think the novel conclusion that he has arrived at is a little precipitate. Earlier workers on triploid *Ænothera* have often hesitated to come to any decisive conclusion with regard to the delicate question of the association of the chromosomes. Gates,⁹ for example, has contented himself with saying that "the chromosomes are scattered for a considerable distance along the long axis of the spindle", and later¹⁰ that the 21 chromosomes are "somewhat scattered along the spindle as is usual in many *Ænotheras*". These difficulties led Gates to

conclude⁹ "that there is usually no metaphase, strictly speaking".

P.S.—Since writing the above I have received a paper by two of the leading authorities on this subject in the United States¹¹ who "have compared the chromosomal phenomena in *Datura* and *Oenothera* and have shown that segmental interchange is a possible basis of circle formation in both genera". Further, these workers have been able to determine the type of configuration that would be shown by a hybrid, from a knowledge of the pairing properties of its parents' chromosomes and the genetical properties of their characters. In four cases tested these determinations (one of them a prediction) were shown by observation to be correct.

Those who are familiar with the sterile speculations prompted by the theory of telosynapsis will notice a welcome change in the close reasoning now being profitably applied to the chromosome analysis of *Oenothera*.

C. D. DARLINGTON.

John Innes Horticultural Institution,
Merton Park, London, S.W.19,
April 11.

¹ Darlington, C. D. *J. Genet.*, 20: part 3; 1929.

² Darlington, C. D. *J. Genet.*, 21: part 1; 1929.

³ Darlington, C. D. *J. Genet.*, 21: part 2; 1929.

⁴ Gairdner, A. E., and Darlington, C. D. *NATURE*, 125: Jan. 18, 1930.

⁵ Newton, W. C. F., and Darlington, C. D. *J. Genet.*, 22: part 1.

⁶ Sheffield, F. M. L. *Proc. Roy. Soc.*, 105 B; 1929.

⁷ Catcheside, D. G. *Trans. Roy. Soc. Edin.*, 56: part 2; 1930.

⁸ Håkansson, A. *Hereditas*, 8: 1926.

⁹ Gates, R. R. *Bot. Gaz.*, 48: 1909.

¹⁰ Gates, R. R. *Ann. Bot.*, 37: 1923.

¹¹ Blakeslee, A. F., and Cleland, R. E. *Proc. Nat. Acad. Sci.*, 16, 1930.

The Integuments of Whales.

IN whales the integuments may be supposed to serve a double or treble purpose: the outer layers—the epidermis and the pars papillaris of the dermis or cutis vera protecting the underlying parts, and the deeper—the thick and oily pars reticulata or 'blubber' preventing the loss of heat, and at the same time diminishing the specific gravity of the body and reducing its tendency to sink.

In the Greenland whale (? also in the Atlantic whale) the epidermis is thicker than in the 'fin whales', and in the Delphinapteridæ (that is, in the narwhal and white whale) it is thicker, although not to the same extent, than in other 'toothed whales'. Moreover, in the Greenland whale and in the Delphinapteridæ a pars papillaris which is tough and does not yield oil is present, a condition not met with in the 'fin whales' and in many of the 'toothed whales'.

Are the integuments thicker in the calf than in the adult? The answer appears to be in the affirmative: the epidermis in the young sperm whale is $\frac{3}{8}$ in. in thickness against $\frac{1}{2}$ in. in the adult, according to Beale, and in the calf of the Greenland whale nearly 2 in. against about half that thickness in the adult, according to Scoresby.

An epidermis 2 in. thick is remarkable, but Scoresby makes the same statement in his "Journal of a Voyage to the Greenland Sea in 1822", and in the log-book of his 1811 voyage preserved in the Whitby Museum.

In the blue fine whale (*B. Sibbaldi*) the blubber is known to be thin and imperfectly formed at birth (see Turner, *Trans. Roy. Soc. Edin.*, vol. 26). Assuming that this is also the case in the 'right whales', might not the great thickness of the epidermis in the calf of the Greenland whale be a protection against the coldness of the Arctic waters until the blubber has reached its normal character and thickness?

As mentioned in Buckland's "Notes and Jottings", p. 352, and recently by Sir Sidney Harmer (see *NATURE*, Feb. 22, p. 286), the 'inner skin' or pars papillaris of the narwhal and white whale were at

one time used in making leather, but, so far as I know, the corresponding layer of the skin of the Greenland whale, although tough and $\frac{1}{4}$ in. thick, according to Scoresby, was never put to a similar purpose. The whalers looked on it as valueless and threw it overboard together with the thick 'black-skin' or epidermis attached to it. Not so the Eskimo; they held it in high esteem as an article of diet. 'Maktuk', the Eskimo name for the rejected part of the whale's integument, is, according to Low ("Cruise of the *Neptune*", p. 261), usually eaten boiled: "when cooked it has the appearance of thick black india-rubber and is soft and gelatinous while its flavour approaches that of the clam". The corresponding parts of the narwhal and white whale were cooked and eaten in the same way. ROBERT W. GRAY.

8 Hartley Road, Exmouth,
April 21.

Search for an Inactive Isotope of the Element 84 (Polonium).

THE elements 81 (thallium), 82 (lead), and 83 (bismuth) have both radioactive and inactive isotopes, whereas the elements 84-92 are only known in an active form. Several attempts have been made to find inactive isotopes of the latter elements. Aston, using his mass spectrograph, tried to discover a stable isotope of radon in the atmosphere, and Hahn made extensive researches to find an inactive isotope of radium. All these attempts failed.

We have recently tried to extend the series of inactive elements by searching for an inactive isotope of the element 84 (polonium), which follows bismuth. Through the work of the discoverer of this element, Mme. Curie, and her co-workers, as well as of Marckwald and of many others, the chemical properties of polonium were found to be intermediate between those of bismuth and tellurium. Hence it is obvious that if a stable isotope exists, it must be associated in Nature with tellurium or bismuth.

We looked for the elements 84, therefore, in the following tellurium and bismuth minerals: Hessonite, calaverite, nagyagite, tetradymite, and bismuth glance as well as native bismuth. The minerals were dissolved, and a known amount of polonium added as radioactive indicator. On removal of the polonium from the solution, it was to be assumed that any isotope present in the solution would accompany the active polonium. By special methods devised for the purpose, it was possible to regain the added polonium electrolytically on molybdenum electrodes, the deposit weighing only about 1/10 mgm. X-ray investigations, carried out by the secondary ray method to avoid the possible volatilisation of the substance under the action of the cathode rays, have shown that the deposit cannot contain more than 1/2 per mille of the element looked for. The X-ray line searched for was polonium La_1 , the wave-length of which was calculated from Moseley's law to be 1111 X.U. All the lines on the plate could be identified as belonging to lead, bismuth, silver, mercury, or tungsten. As we started with about 400 grams of each of the minerals mentioned, 1 gm. of each mineral cannot contain more than 10^{-7} gm. of the element in question. This negative result is in agreement with generalisations arrived at by Dr. A. S. Russell.

There is thus very little hope of finding an inactive polonium isotope, or of extending the series of radioactive elements which now exists beyond 83 (bismuth).

G. HEVESY.

A. GUENTHER.

Institute of Physical Chemistry in the
University of Freiburg im Breisgau.

The Oldest Record of a Slug.

MISS ALICE MACKIE, writing from Egypt, sends me a photograph showing a couple of slugs represented on a wall at Karnak (Fig. 1). These figures are of course well known to Egyptologists, but probably not to malacologists. They appear to represent the species *Veronicella nilotica* (Cockerell, *Nautilus*, January 1910, p. 108), which was found by the Nile above Khartoum. In my original account I could only give the coloration as shown by alcoholic material. Mrs. G. B.



FIG. 1.

Longstaff found a specimen among papyrus on the river bank at Hillet al-Nuwer, an islet on the Bahr el-Gebel. She noted that the living animal was very dark grey above, beneath dirty yellow turning to deeper yellow anteriorly.¹ This agrees sufficiently with the Luxor figures, which are shown to be dark above and pale below. As this is the only slug of the kind known from this region, the identity is reasonably certain.

T. D. A. COCKERELL.

University of Colorado, Boulder,
Colorado, Mar. 30.

¹ Robson *Journal Linnean Soc.*, Zoology, 32, p. 268, 1914.

Polarisierte und gerichtete Röntgenstrahlung aus einem Kristall.

DURCH mehrere experimentelle Untersuchungen habe ich festgestellt, dass die Atome der Elemente Wasserstoff und Helium eine ausgezeichnete Achse besitzen, in Bezug auf welche die Gleichgewichtslagen ihrer Elektronen angeordnet sind. Auf Grund spektraler Analogie kann man folgern, dass auch bei den schweren Elementen die Elektronen an der Atomoberfläche in Bezug auf eine ausgezeichnete Achse angeordnet sind.

Analog sind im Innern und auf dem Grunde der Elektronenhülle der schweren Atome die Elektronen in Bezug auf eine ausgezeichnete Achse angeordnet. Dies lässt sich aus einer Erscheinung folgern, welche ich kürzlich aufgefunden habe; es ist die Erscheinung der Polarisation und der gerichteten Intensitätsverteilung der *K*-Strahlung eines Elements aus einem Kristall. Die sekundäre *K*-Strahlung des Brom-Atoms, welche infolge der Absorption primärer Röntgenstrahlung von monoklinen γ , γ -Dibromanthrazenkristallen emittiert wird, zeigt nämlich folgende Eigenschaften: in Bezug auf die Achse, welche senkrecht zur Symmetrieebene steht, ist in einer Richtung, welche senkrecht auf dieser Achse steht, die

Intensität der sekundären *K*-Strahlung der Bromatome des Kristalls grösser als in einer Richtung von kleinerem Winkel gegen jene Achse; ausserdem ist diese Strahlung der Bromatome zum Teil in der Weise polarisiert, dass die Intensität der elektrisch parallel jener Achse schwingenden Strahlung bis zu 20 per cent grösser als die Intensität der senkrecht dazu schwingenden Strahlung ist.

Aus diesen Eigenschaften der *K*-Strahlung der Bromatome aus Dibromanthrazen lassen sich folgende Schlüsse ziehen: 1. die Achsen der chemischen Moleküle in dem Dibromanthrazenkristall liegen parallel zu einander; 2. die Valenzachsen der Bromatome in diesem Kristall sind einander parallel; 3. die Elektronen der untersten und der nächsthöheren Schale des Bromatoms, welchen die *K*-Strahlung zugeordnet ist, besitzen in Bezug auf eine ausgezeichnete Achse bestimmte Lagen.

Ein ausführlicher Bericht über die vorstehende Untersuchung wird voraussichtlich in den *Annalen der Physik* erscheinen.

J. STARK.

Grosshesselohe-München,
April 15.

The Ancestry of Man.

THE theory I have been advancing during the last two years that man is not descended from the apes, but from a primitive common anthropoid stock which gave rise to the apes as well as to our own direct ancestors, has gradually come about from the intensive study of fossil man the world over as well as from our recent and more extended knowledge of the anatomy and the habits of the apes. This new knowledge reveals data entirely unknown to Darwin, and he to-day would be among the first to grasp the new outlook and give it his unbiased consideration. I regret to find that advanced and entirely unauthorised reports of my presidential address before the American Association for the Advancement of Science at Des Moines were interpreted as disloyal to Darwin's theory of the descent of man. More extended knowledge of the data on which the new point of view is founded will cause such criticism to subside, as disloyalty to the main features of Darwin's theory of the descent of man is unthinkable.

It seems that in human palaeontology new ideas of time and space, as well as of heredity and of the principles of descent or phylogeny, are compelling us to recast or reconsider all the older ideas to which we fell heir at the close of the nineteenth century. I regret that pressure of other work compels me to postpone the assembling of fresh facts and the meeting of many of the arguments which are now being advanced by several authorities for the older point of view. Like all other questions of descent, the problem of human ancestry can only be settled by fresh palaeontological discovery. In view of the fact that anthropoid ape remains are very rare and that primitive human remains are still more rare, we may have to wait for several decades before the fortunate discovery is made. The ancestors of man were the most clever of all animals and, therefore, the first to avoid natural burial and fossilisation.

HENRY FAIRFIELD OSBORN.

Osborn Research Rooms,
American Museum of Natural History,
April 7.

Scattering of X-rays by bound Electrons.

IN 1923, Compton gave a theory with experimental verifications of scattering of hard X-rays by free electrons, and in a subsequent paper he considered theoretically the case of modification of radiation scattered by bound electrons (Compton: "X-rays and Electrons", p. 286) in which the latter may be removed from one orbit to the other. Recently, I have observed that a part of the monochromatic X-rays in passing through carbon undergoes a change in frequency and appears on the longer wave-length side of the primary radiation. Copper $K\alpha$ radiation was allowed to pass through carbon soot and the transmitted radiation was analysed by a calcite crystal fitted up in a Siegbahn spectrograph. A current of 8 m.a. was passed through the X-ray tube at a peak voltage of 28 k.v. In addition to the original copper $K\alpha$ radiations and other lines in the tungsten L -series, a new diffuse broad line of wave-length 1592 X.U. ($\nu/R = 572$) appeared on the photographic plate. This new line appears to have a more or less sharp edge on the short wave-length side. The wave-length of this line was compared with those of other lines the presence of which might be expected from the X-ray tube excited under the given condition and was found not to coincide with any one of them. The time of exposure was varied from 8 to 14 hours in different cases and all of them showed the same effect.

The origin of this line may be explained by the fact that the copper $K\alpha$ radiation in passing through carbon loses a part of its energy equal to that of removing the electron from the K -shell either to the optical level or to infinity. The frequency difference between this line and the original copper $K\alpha$ lines is 20.1 (in ν/R), whereas the value of carbon $K\alpha$ is 20.4 (in ν/R : Soderman, *Zeit. f. Phys.*, 52).

It may be mentioned here that the possibility of this type of radiation was also predicted by Kramers and Heisenberg, and it shows a certain similarity with the Raman effect in molecules.

Nickel $K\alpha$ radiation produces a similar effect on passing through carbon. Further, this effect has also been observed in the case of oxygen and nitrogen for copper $K\alpha$, nickel $K\alpha$, nickel $K\beta_1$, tungsten $L\alpha_1$ radiations, the measurements of which with photographs will be published in due course. B. B. RAY.

University College of Science,
92 Upper Circular Road, Calcutta,
April 8.

The Identity of Colloidal Particles in Soap Sols and Gels.

DR. M. E. LAING MCBAIN and Prof. J. W. MCBAIN found about ten years ago that several properties, for example, the conductivity, lowering of vapour pressure, concentration of sodium ion, etc., of the sols and gels of sodium oleate are identical; and from this they came to the conclusion that the colloidal particles in the two states are identical in nature and amount.

It is well known that light scattering gives us an accurate idea of the delicate changes in the colloidal particles in sols and gels, and is therefore a very significant property of colloids. During my investigations on the scattering of light in soap sols and gels I found that the intensity of the light scattered by gels of sodium oleate is distinctly greater than that in sols at the same temperature (*NATURE*, Nov. 2, 1929, p. 690). In a recent letter to *NATURE* (Jan. 25, 1929, p. 125) Dr. M. E. Laing McBain and J. W. McBain report that they have succeeded in preparing samples of the same solution of sodium oleate, some

of which were fluid sols and others typical jellies, but the light scattering of which was identical within the limits of experimental error. They further suggest that the enhanced intensity of the scattered light in the gels observed by me might be due to a partial curdling or crystallising out.

It may be permissible to point out here that J. W. McBain appears to have previously observed a slightly enhanced opalescence during the formation of gels from soap solutions (cf. McBain's article in J. Alexander's "Colloid Chemistry", vol. 1, p. 140), though the other properties, such as electrical conductivity and lowering of vapour pressure, remain unaffected.

K. KRISHNAMURTI.

Sir William Ramsay Chemical Laboratories,
University College,
London, W.C.1.

Intensities in Band Spectra.

PROF. E. CONDON (*Phys. Rev.* 32, p. 858; 1928) has shown that on the basis of the new quantum mechanics, certain nuclear transitions associated with electronic transitions are more probable than others. The actual intensities of the lines emitted depend upon the integral of the electric moment and the wave functions of the initial and of the final states. The evaluation of this integral can be approximately carried through for symmetrical diatomic molecules. The intensities of the lines associated with vibrational electronic transitions may therefore be calculated and expressed in terms of the change in separation of the nuclei during the transition.

The intensities calculated by this method agree very well with experiment especially in the case of the alkali molecules. The calculated intensities for Na_2 and K_2 at the positions (1-2) and (2-1) in the band spectra double entry table for intensities are very small, thus being in good agreement with the experimental intensities given by Fredrickson and Watson (*Phys. Rev.*, 30, p. 429; 1927). The occurrence of a large number of transitions between high quantum states for iodine is also explained. There are certain regular deviations from experiment in the case of hydrogen that have not as yet been explained. The complete calculations will be published in the *Physical Review*.

ELMER HUTCHISSON.

Berlin, Friedenau,
April 17.

The New Planet.

I SEE that, in the notice which appeared in *NATURE* announcing the discovery of the new planet, it was suggested that the object might represent the outermost member of the family of planets formed from a portion of the sun drawn out by the attraction of the star the approach of which caused the catastrophic formation of the planetary system; or, as it was put—the new planet might be formed from the tip of Sir James Jeans' cigar. Since then the further particulars of the orbit appear to indicate that it is cometary in character, being eccentric and inclined at a considerable angle to the ecliptic. These two divergencies from the characteristics of the previously known planets, coupled with its great distance, would appear to be better explained by the theory of capture. At least, it may be said that the capture theory deserves consideration. If capture is possible, the new planet might be regarded as the first of a new series. Further, if the capture theory were actually established, by implication it would be probable that the majority of the stars have captured planets.

G. F. DANIELL.

Maidstone, April 25.

Angler-Fishes.*

By Dr. C. TATE REGAN, F.R.S.

THE fins of fishes are formed of a membrane supported by rays, which are generally flexible and jointed. But in one great group of fishes—the perch group—some of the fin-rays, and particularly the front rays of the fin on the back, are converted into strong, sharply pointed spines, weapons of attack and defence. It might be thought that these specialised structures would be end-products of evolution; but that is not so, for in various offshoots of the perch tribe the spines are modified for other purposes. In the flat-fishes, which swim by undulating movements of the body and the long marginal fins, the spines are reconverted into articulated rays—an example of reversible evolution. In the sucker-fishes, which attach themselves to sharks, turtles, and other marine animals, the spinous dorsal fin is transformed into a laminated adhesive disc placed on top of the head. In the angler-fishes the spinous rays of the dorsal fin have become slender and flexible, and the first is placed on the head, and forms a line and bait.

The angler-fish found in British seas has a large flat head, and a wide mouth furnished with sharp depressible teeth. The bait is a flap of skin—sometimes white in colour—placed at the end of the line, near the mouth. The angler lies on the bottom—and waves about the bait, which is perhaps better termed a lure, for it is not meant to be seized—and so entices other fishes near enough to be caught.

In the seas of other parts of the world there are other anglers more or less similar to ours. In some of these, as in *Lophiomus naresii* from New Guinea, the skinny flaps that look like weeds, and help to conceal the lurking fish, are much more developed than in the British species.

Another group of anglers includes a number of small fishes, compressed in form, and often brightly coloured and marked with patterns of stripes or spots. They are found in warm seas, many inhabiting the crevices of coral reefs. One lives among the *Sargassum* weed, where its coloration of mottled brown on yellow renders it inconspicuous.

The two groups of anglers so far described include fishes that live in the light; they have a coloration that harmonises with the ground on which they lie, or the rocks and weeds amongst which they rest, and their lure is a flap or a tassel at the end of the line. A third group includes the anglers that live out in the ocean, and deep down in the dark, generally from about 100 fathoms to 500 fathoms below the surface; not at the bottom, but in mid-water. These are uniformly coloured, generally blackish. Their lure is luminous, the swelling at the end containing a glandular sac with a luminous secretion; the sac is partly enclosed in a pigmented cup, lined inside by a peculiar membrane that acts as a reflector; the light shines

out through the mouth of the cup, and there is some evidence that it can be turned on or off at will. Generally the mouth is large, and the teeth are strong, sharp, and depressible inwards.

Another peculiarity of the oceanic anglers is the extraordinary distensibility of the stomach. In the depths of the ocean meals are scarce, and the angler does not want to refuse one because it is too big. There are several examples known of anglers that have swallowed fishes two or three times their own length and several times their own weight; two of these had just begun to digest the fish they had swallowed, and then took baits and were hooked and caught on lines! Others have been carried upwards by the struggles of their victims when these were first seized, and have been found at the surface of the ocean, alive but helpless. I believe that these could not have escaped their fate, for their teeth are so arranged that they hold the victim that is struggling to escape, but lie down and allow a little more of it to pass inside every time its efforts relax; so that eventually it is completely engulfed, and makes a considerable alteration to the figure of its captor.

In *Linophryne* the teeth are stronger than in any other angler. In *L. arborifer* the large luminous lure is carried by a short stout line, and below the chin is a large branched barbel, or beard. The use of this appendage is unknown; it may be luminous, or the little swellings on the terminal branches may be sensory organs, perhaps giving warning of the approach of other fishes. In other species of *Linophryne* the beard is different in structure, and the lure may have a series of filaments on each side of the bulb.

Edriolychnus has the skin translucent, although the stomach is pigmented; the luminous organ is sessile, without any line. *Gigantactis* is remarkable for the long fine line, in one species four times as long as the fish itself. One is reminded of a fly fisherman. The movements of the small lure may imitate the swimming movements of a small luminous animal.

The line is a fin-ray, and like other fin-rays is articulated to the end of a basal bone; this lies in a hollow on top of the head, but in *Gigantactis* its end projects. In *Dolopichthys* the basal bone projects more distinctly, and in some other anglers the whole of it may be permanently protruded, and it may increase in length, forming a rod.

Lasiognathus (Fig. 1) is a complete angler, for it has not only a rod and a line, but also a triangle of hooks, like those used by a pike-fisherman. In this extraordinary fish the upper jaw is connected to the head by a membrane; the prey, perhaps brought to the mouth by the hooks, must be completely enclosed by a downward movement of the upper jaw, when the membrane connecting it to the head forms the sides of a pouch; the teeth are bristle-like, of no use for piercing, but meeting across and closing the gap in front of the lower jaw,

* Friday evening discourse delivered at the Royal Institution on Mar. 7.

when the prey is inside the mouth. I suspect that this fish may feed on Pteropods, which are small enough to be taken in whole, and would offer a good hold for the hooks.

There is a considerable diversity among the anglers of the ocean. The lure differs greatly in size and form, and may be sessile on the head, or

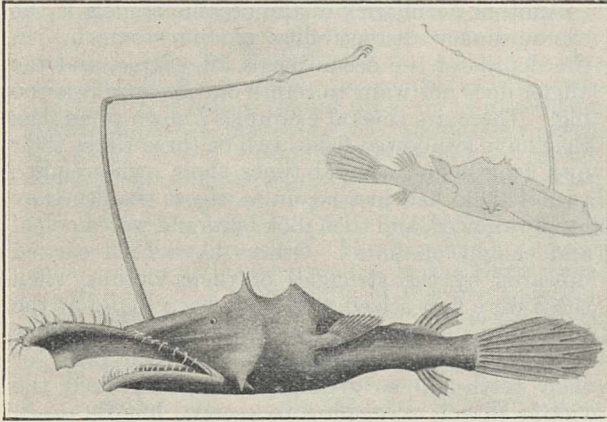


FIG. 1.—*Lasiognathus saccostoma*. Natural size.*

at the end of a short or a long line, and the line may or may not be connected with a rod; one fish even has hooks, as well as a rod and line. We can get some idea of the meaning of this diversity if we reflect that human anglers specialise; there are salmon fishermen, trout fishermen, pike fishermen, and roach fishermen, each using a different sort of rod, line, and bait or lure. Moreover, human anglers may use a variety of baits for the same fish; the trout fisherman, for example, may use artificial flies, spinning minnows, or worms, not to mention other methods. It would also be of advantage to the angler-fishes to display a variety of lures, for if all fished with the same bait, in the same way, the inhabitants of the ocean might come to look upon it as a danger signal.

The typical members of the group have a uniform coloration, a luminous lure, a large mouth, strong teeth, and a very distensible abdomen. This is an example of correlated adaptations; these characters are related to the habits and conditions of life of these fishes, and can scarcely have been evolved by accident, which is a modern theory of evolution that has some popularity.

Further correlated adaptations have developed within the group. In *Himantolophus* the lure is very complicated in structure, with numerous tentacles, ending in luminous tips. In young examples of this genus, about 2 inches long, the lure is simpler, and the mouth smaller, than in the adult. At a still earlier stage, as in all these anglers, there is no line or lure; it grows out from the head. These young fishes, with relatively small mouth and feeble teeth, and with the lure absent or little developed, live nearer the surface than the adults, and feed on minute organisms. But some retain these juvenile habits throughout

life; they never grow to more than two inches long, and the line and lure do not develop. *Lipactis* is very similar in structure to a young *Himantolophus*, but has no lure, somewhat larger eyes, and much larger nostrils, indicating that it seeks its food by smell and sight. The species of *Rhynchoceratias* differ in their pincer-like jaws, and some by still larger nostrils. The final stage in this series—*Aceratias*—differs from *Rhynchoceratias* in having the eyes directed forwards (Fig. 2); and the snout is shortened in relation to stereoscopic vision, as in man. This little fish differs considerably from the typical anglers of the ocean; but its modifications of structure are all related to the adoption of a new habit, search for food by smell and sight.

Neoceratias (Fig. 2) is probably related to *Gigantactis*; it has also lost the line and lure and developed the olfactory organ, but on a different plan, one nostril being at the end of a tube. This curious fish has teeth outside its mouth, on the surface of the head; each is long, slender, hooked at the end, and inserted in a muscular papilla, so that it is independently moveable. One may imagine the ends of two or three teeth coming together to catch something, and then passing it on to the other teeth, until it gets inside the mouth.

Now comes the most remarkable thing of all. All these free-swimming oceanic angler-fishes, black and mostly rather terrible in appearance, are females. The only males of this group known are

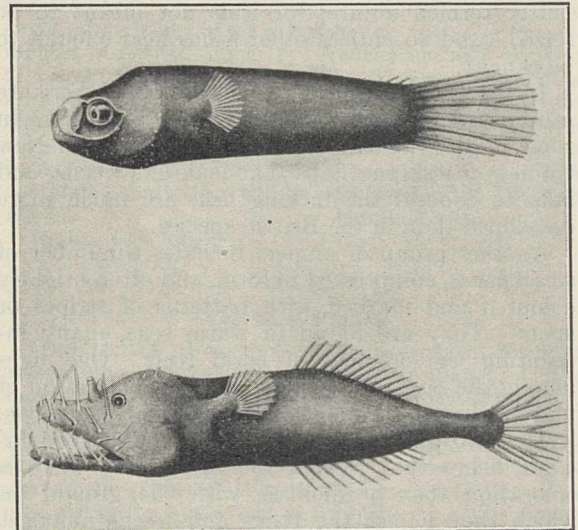


FIG. 2.—Above, *Aceratias macrorhinus* ($\times 2$); below, *Neoceratias spinifer* ($\times 3$).

dwarfs parasitic on the females. A pair of fishes was taken in a trawl to the south of Iceland; they belong to a genus—*Ceratias*—distinguished by the spiny skin, and by the very long rod and short line. The wife is 40 inches long; her husband is only 4 inches long, so that she is a thousand times his weight. He is attached to her in the mid-ventral line. The male (Fig. 3) has a general similarity to the female; but he has no line and bait, and no teeth. He is attached to her by

* The figures are taken from two sets of picture postcards issued by the British Museum (Natural History), entitled "Oceanic Angler-fishes", and sold at 6d. a set of five cards, with leaflet.

means of outgrowths in front of the snout and of the lower jaw, which meet in front of the mouth and unite with a prominence on the skin of the female. The union is so complete that it is difficult to say where one fish begins and the other ends; the connecting tissue is fibrous and full of blood-vessels, the general direction of which is from one fish to the other, and the male is a mere appendage, nourished by the continuity of his blood system with that of the female. He is quite incapable of feeding himself, for his mouth is closed in front and has no teeth, and his digestive system is reduced to a vestige. But he has a heart, and gills, so that he is able to breathe; water for respiration enters through the mouth. Another large female *Ceratias* was so fortunate as to possess two males, attached close together on the side of her abdomen.

arrangement, which has the advantage that the mouth has more room for the intake of water for respiration.

These fishes are unique amongst backboned animals in having dwarfed and parasitic males, and unique among all animals in their method of parasitism, for in no other animal is there a union of the blood-systems of host and parasite. The nearest approach is the embryo of the placental mammals, where also parasite and host are of the same species.

Now if we consider the habits and conditions of life of these fishes we can understand the evolution of the dwarfed and parasitic males. The oceanic anglers are feeble swimmers; they float about waiting for their prey, and they are necessarily few in numbers as compared with the more active fishes that they attract with their luminous lure.

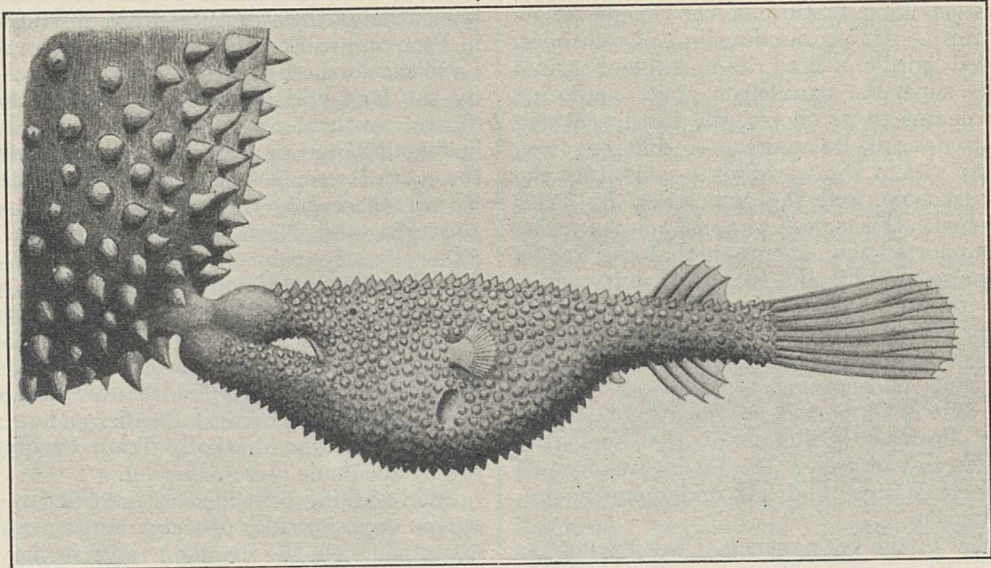


FIG. 3.—*Ceratias holboelli* (male). Natural size.

In these fishes the eggs are shed in the sea, and the males must be free when they are first hatched, and attach themselves if they find a female, first holding on by the mouth, and then becoming grown to her.

In *Photocorynus* a female three inches long has a male only $\frac{2}{5}$ of an inch long attached to the top of her head above the right eye. In *Edriolychnus* a female about 3 inches long has a fully adult male, $\frac{3}{5}$ of an inch long, attached under the spine of the præoperculum, and upside down. The attachment of the male *Photocorynus* is of the same type as in *Ceratias*, by means of outgrowths in front of the snout and the lower jaw, whereas in *Edriolychnus* the main attachment is inside the mouth, which is choked up. In both we must suppose that the male first nipped a piece of the skin of the female between his jaws, and that the ends of the lips fused with the papilla so formed. Then if the tongue pressed against and fused with this papilla inside the mouth, the *Edriolychnus* arrangement would result; but if it were pushed forward between the branches of the lower jaw to effect a union with the female below the mouth, subsequent growth would give the other

They live a solitary life, and they are in the dark. Imagine such a fish, out in the middle of the Atlantic, perhaps half a mile below the surface; How could it find a mate? But there may be thousands of males in a brood, hatched out at the same time from the eggs shed by a single female; and if these at once look for females, the chances of finding one are much greater than if they waited until later, when their numbers had diminished. If they are lucky enough to find one they unite with her and develop at her expense; if not, presumably they perish.

These extraordinary habits of the males have led to the degeneration of the organs they no longer need—the lure, the teeth, and the digestive system.

The males of these oceanic angler-fishes are another example of correlated adaptations, of several independent changes of structure related to new habits. These cannot be explained by the theory of evolution by accident—of changes of structure being due to changes in the germ-cells, that have no relation to habits and environment. They fit in better with the theory that the actions and reactions of the animals themselves result in modifications of structure that become hereditary.

The Geological History of the Pacific Ocean.*

By Prof. J. W. GREGORY, F.R.S.

THE Pacific Ocean, as the greatest geographical unit on earth, with an area greater than that of all the land, presents the difficulties as well as the attraction of its size. Its broad trigonal shape, nearly 10,000 miles wide from New Guinea to Peru, forms a striking contrast to the relatively narrow trough of the Atlantic; and the differences in size and shape render the recurrence of the same structural and biological units, which is so conspicuous with the opposite coasts of the Atlantic, less likely with the Pacific. Its 3000 islands give little evidence as to its geological history, for most of them are composed of comparatively young volcanic ejecta or coral rock.

The first striking feature of the Pacific is its apparent unity. Its surrounding lines of volcanoes, the so-called 'girdle of fire', its unstable marginal earthquake zone, the parallelism of its bordering mountain chains to its shores, the features which led Suess to describe its coasts as so different from those of the rest of the world as to constitute the Pacific Coast-type, and the association by Prior and Harker with this type of a special suite of rocks, have all supported the conclusion that the Pacific Ocean has a geographic and geological unity which indicates its permanence throughout geological time. This view, urged by Dana in 1846, has been adopted by many geologists, such as Russell Wallace, and palæontologists such as W. D. Matthew, and is supported by the recent verdict (1929) by Professor Schmidt of the Zoological Museum, Leningrad, that "The Pacific was formed in very ancient times and has undergone no important changes".

This belief in the permanence of the Pacific has been rejected by many authorities. The existence of a Pacific continent was advocated in his presidential address to the Geological Society sixty years ago, by Huxley. That the Pacific is the oldest ocean is accepted by some authorities, as von Huene, who reject its permanence. In 1899, however, I argued against the Pacific Ocean having been permanent, and expressed the view that "the Pacific Ocean may have undergone great changes later than the other oceans". To that opinion I still adhere.

Faith in the unity of the Pacific was strengthened by widely accepted theories of its origin. The view that the Pacific Basin is the hollow left when the moon was torn away from the earth is untenable, as the moon is 37 times too big and 20 per cent too heavy. The standard geological theory of the origin of the Pacific is that of Suess, who inferred from the parallelism of the surrounding mountains its unity of origin and from the marine Triassic rocks on the coasts its Triassic age.

That the margins of the Pacific have been greatly altered is certain. All authorities on the geology of the East Indies agree that they are fragments

of a continuous land, which lasted throughout the Palæozoic and extended far into the Pacific. This ancient Malaysia was continued northward as the Cathaysia of Grabau by which China extended eastward into the Ocean. Australia, it is generally accepted, was once continued eastward to Fiji and New Zealand, while Asia extended, south of Japan, to the line of the Liu Kiu and Ladrone Islands.

On the American side the former occupation of the eastern Pacific by land—the Schuchertland and Burckhardtland of von Ihering—is necessary to explain the stratigraphy of western America, the coarse conglomerates in Chile, and the sudden truncation of the structural grain of South America in Peru and in Ecuador near Paita.

On the northern side the Pacific was once occupied by the land-bridge from Mongolia to the United States, south of the Bering Sea, which was used in four different epochs by large quadrupeds. To the south the replacement of sea by land is affirmed by all those who believe in the connexion of Australia and New Zealand to South America either directly or by Antarctica.

A marginal reduction of the Pacific is, however, not enough, for many botanists, zoologists, and palæontologists, from very different lines of evidence, insist that the range of plants and animals, living and extinct, requires the existence of extensive lands in the Central Pacific, and probably of land lines nearly or wholly Trans-Pacific, such as the Archigalenis of von Ihering.

Such striking coincidences in structure as occur on the opposite sides of the Atlantic are not to be expected with the Pacific; and it may be impossible to disprove that the community of organisms in America and Asia is not due to passage across the Bering Sea: but in many cases that route is improbable, as it was not in existence at the time required, or was too far north to be in a suitable zone of latitude. Many zoologists claim that the chief Pacific islands have been peopled either by inhabitants who developed in the Central Pacific or reached the islands there by migration across a land connecting them with the continent to the south-west that occupied Polynesia.

The geological evidence is fully consistent with this conclusion. It indicates not a persistent Pacific Ocean, but the occupation of its site by a succession of narrow seas separated by land and with a predominant trend west and east. Thus in the Lower Cambrian the Olenellus Sea to the north was separated from the Redlichia Sea to the south-west; in the Middle Cambrian one sea spread from the Himalaya to the Rocky Mountains, and an arm of it, in the Upper Cambrian, overspread eastern Australia. The whole of the southern Pacific from New Zealand to South America may have been land, for the only Cambrian in South America was an arm of the Atlantic.

The Ordovician in Pupiao in southern China

* Presidential address to the Geological Society of London on Feb. 21.

has "scarcely any trace of an American element"; the fauna there is European. China and western America had no direct marine connexion.

In the Devonian the East Indies and the China Sea were occupied by a land that extended into the western Pacific and bounded the sea by which the European fauna reached south-eastern China and Tongking. In the Middle Devonian the sea with the Flabellites fauna lay along western South America and in the valleys of the Amazon and Mississippi; but it did not reach Australia, where, in the Upper Devonian, the Chemung fauna of New York invaded New South Wales: the absence of this fauna from Asia and California shows the separation of the north-western and south-eastern Pacific seas.

The Carboniferous had the same separation of the Asiatic and West American marine faunas; and evidence of land is given by *Gigantopteris*, a member of the Gondwana flora, which is found in southern and eastern China and in Texas, and doubtless entered both from a Pacific land.

The Trias has a wide range around parts of the Pacific, but was deposited in separated seas—an Arctic Ocean with a gulf to British Columbia: the western end of a southern European sea which reached Venezuela and South California; the eastern end of the same sea extended past the Himalaya to New Zealand. It is represented in New Zealand by a distinct province which was in a gulf and was not the opening to a Pacific Ocean. Evidence of trans-Pacific lands in the Trias is given, according to von Huene, by the affinities of the Triassic reptiles of South America to those of India.

The Jurassic was the time of the main development of the Pacific continent of Haug. The Liassic sea of the North Pacific was separated from the contemporary seas in Central and South America. The Malm fauna of Chile ranged westward to the Himalaya, but was different from that of the North Pacific and the European fauna in the Antillean region. The Pacific region in the Upper Jurassic according to Uhlig was occupied by faunas of four geographical provinces.

In the Cretaceous shallow water connected California and India; while later a land separated the Senonian faunas of California and Japan from that of Chile and New Zealand. The North Pacific was crossed by the giant Sauropods in their range between Mongolia and Montana, and a land route in a suitable latitude was used twice later by large quadrupeds. The South Pacific was crossed in the Cretaceous by reptiles, that migrated between South America and Asia, as the route via North and Central America was not then available. Lands west of America allowed the diffusion of the Dakota flora (Turonian) southward to the Argentine.

In the Kainozoic Era the trans-Pacific lands seem to have lasted until the Oligocene or early Miocene, since the alligator, various reptiles, amphibia, insects, crayfish, land mollusca, primitive mammals, etc., indicate migration routes across the tropical and warm temperate zones. Land plants do the same, for Asa Gray showed that the floras of China and the southern humid areas of

the United States have much in common. *Gordonia*, one of the plants found in both areas, helps to fix the date of the migration, as it has been recently discovered by Berry in the Miocene of the Rocky Mountains.

The occurrence of similar animals and plants on opposite sides of the southern oceans has been explained by their origin in a northern land or their independent evolution. The northern monopoly of evolution is opposed by the theory of Ernst Schwarz of the southern origin of the mammals, and the evidence of the development of various animals, including some freshwater fish (vide Regan) and many plants in the southern land. The evidence of parasitology renders the alternatives to the spread of some animals across the southern Pacific, according to Launelot Harrison, "merely grotesque".

The life of the Pacific islands, according to many authorities, can only be explained by the existence of extensive Pacific lands on which developed a Eu-Pacific fauna and flora. These lands must have been connected with Polynesia and Australasia; and were probably united to the former extension of the Andes to the north-west of Peru; according to Steinmann his Chimu-andes extended to Hawaii and Polynesia, and were cut off from South America at the end of the Eocene.

Lands survived across the Central Pacific apparently until the Lower Kainozoic; but as the higher mammals and birds characteristic of the Upper Kainozoic are distinct on opposite sides of the Pacific, the land-bridges were destroyed before these animals could use them.

Darwin's theory of coral islands—now established by the boring at Funafuti, gravity observations on Jaluit, the widespread presence of mid-Kainozoic foraminiferal limestones, the drowned nature of the coasts of many of the islands, and the botanical evidence from the Marquesas of their subsidence for thousands of feet—implies the sinking of a belt across the Southern Pacific during the Upper Kainozoic.

The evidence of the sedimentary rocks that the crust subsides to amounts up to 50,000 feet is opposed to the extreme form of isostasy, which denies the possible uplift of an ocean floor. The arguments in favour of that view, based on a sub-oceanic heavy stratum, as proved by the distribution of igneous rocks, gravity observations, and the speed of earthquake waves, rest on such doubtful assumptions that geologists should be guided by the direct geological evidence.

The long Altai and Alpine mountains were doubtless continued across the Atlantic and the Pacific by at least raised belts. The ending of the Altai line in the south-eastern part of the main island of Japan, and of the Alpine lines in southern China and the East Indies indicate their former extension into the Pacific. Its floor must have been disturbed by the forces that crumpled strips across the whole length of Eurasia into fold-mountain chains, by the mutual pressure between the northern dome of the world and the protuberant tropical belt.

News and Views.

CONGRATULATIONS and good wishes are offered to Dr. George Claridge Druce, who will be eighty years of age on May 23. The story of his earlier years has been told by Dr. Druce himself in the introduction to the "Flora of Buckinghamshire" (1926), the third of his series of floras descriptive of the Thames valley counties. The autobiography tells of difficulties successfully overcome by hard work and perseverance, and is an interesting record of the zeal and industry with which from early boyhood Dr. Druce has, almost literally, pursued the study of our British flora, and has gained a knowledge of the rarer plants in their native habitats which is unique. This has been achieved in the intervals of an exacting business life—that of a pharmaceutical chemist. For many years Dr. Druce has been honorary curator of the Fielding Herbarium at Oxford, and, in association with a former professor, Dr. S. H. Vines, has published accounts of the historic collections at the University, notably the Dillenian and Morrisonian herbaria. The field botanist is indebted to him for a modern edition of the best used handbook on British plants—Hayward's "Botanist's Pocket-Book"—and Dr. Druce has also himself compiled a "List of British Plants".

SINCE 1904, Dr. Druce has been the moving spirit of the Botanical Exchange Club, the annual report of which supplies records and critical notes on members of the British flora. In 1908 its circle of interest was extended by the formation of a society which should include well-wishers in addition to active workers. Dr. Druce's botanical interests are not limited to the British flora. He has travelled widely, his visits extending so far as Australia and South America. Our latest news of him was that he was botanising in Cyprus, an account of a former visit to which he recently described at a meeting of the Linnean Society. That Dr. Druce should have received an honorary M.A. degree and later the Sc.D. of Oxford is evidence of the esteem in which his work is held and the position he has won in the University town in which he has for many years lived and worked. A further recognition was the fellowship of the Royal Society, to which he was elected in 1927.

It is now well known that certain forms of vomiting are primarily caused by depletion of the body's store of carbohydrate: in such conditions the administration of an easily assimilable sugar is an important part of the treatment. All carbohydrates are absorbed after digestion as monosaccharides and ultimately converted into glucose or glycogen: hence for quickest absorption without the need for preliminary digestion glucose is indicated. It is useful in the prevention of cyclical vomiting in children, as a source of food in starvation during illness, in the cure of insulin hypoglycæmia, and has been recommended in surgical shock, chloroform poisoning, and asthma. The vomiting of sea-sickness is frequently preceded by acidosis; the administration of glucose may prevent it, or may abolish it if it has

already occurred. There is evidence that certain toxic agents exert a less deleterious action on the liver when that organ contains a good store of glycogen: glucose is the simplest form of carbohydrate to administer to ensure rapid filling of this store. Pure medicinal glucose can be obtained in the form of a white powder from Messrs. The British Drug Houses, Ltd., London, N.1: for the preparation of a sterile solution suitable for subcutaneous, intravenous, or rectal injection, it is also issued in a concentrated sterilised solution in sealed tubes.

THE earthquake of May 5, which was recorded at Kew Observatory at 13 hr. 58 min. 11 sec. G.M.T., was the strongest, indeed the only great destructive earthquake, ever felt in the south of Burma. The centre seems to have been near Pegu, the ancient capital of the country. Of this city of 14,000 inhabitants, the greater part is destroyed, the pagoda, the municipal offices and the main street being in ruins. After the earthquake, a fire broke out in the most congested quarter of the town and an area of about two square miles was swept by the flames. As in San Francisco, Tokyo, and Yokohama, they spread unchecked owing to the destruction of the water-mains. The number of persons killed in Pegu is estimated roughly at from 600 to 1000, not an excessive number seeing that the earthquake occurred at night. At Rangoon, about 45 miles to the south-south-east of Pegu, 46 deaths are reported, while many buildings are seriously injured. The total number of shocks felt in Rangoon up to 1904 is given by Montessus de Ballore as only five, of which one in 1888 was strong enough to throw down a few chimneys, and another, 1894, to unroof or shatter some, but not many, houses. Farther to the north, in the district surrounding Amarapoora and Ava, shocks are much more frequent, while that which occurred on Mar. 23, 1839, must be reckoned as one of the world's great earthquakes. It may be of interest to add that the burned-out areas of Tokyo and Yokohama in 1923 contained about 7 square miles and 3 square miles respectively, while that covered by the great fire of London in 1666 was not more than two-thirds of a square mile.

In 1898 the British Association met in Bristol, and in the following year a University College Colston Society was formed, on the lines of the Colston societies already in existence commemorating the work of Edward Colston, but for the express purpose of supporting University College, Bristol. After various slight changes of title, the society still exists as the Colston Research Society, a unique association of citizens for the promotion and assistance of research in the university of their city. A brief history of the Society and record of its work has been prepared by Dr. Morris W. Travers. For a number of years the Society's activities took the form of an annual appeal in the president's name, as a result of which about £500 a year was handed over to the Council of University College, Bristol. In 1908 a part of the Society's

funds was diverted to the promotion of the scheme for a University of Bristol, and with its foundation the Society used its funds to finance research in the University. An experiment in the form of industrial research fellowships was inaugurated in 1922, and six industrial firms each agreed to subscribe £150 for the support of as many research fellowships for one year, the donor having the right to choose the line of research adopted. The scheme proved difficult to work in the University laboratories and has not been repeated. In 1927 it was announced that a fellowship had been established in connexion with cardiac research being carried on in the University, thus reverting to one of the original aims of the Society. Last year the Society received a sum of £5000 from Mr. R. H. Mardon to form a trust fund for the endowment of research, and Mr. Mardon also made himself responsible for the additional charges for incorporation of the Society which his gift necessitated. The citizens of Bristol can look back on their steady support of research and higher education with pride and satisfaction, and it may be hoped that their Colston Research Society will be copied in other university cities of Great Britain.

THE thirty-sixth James Forrest Lecture of the Institution of Civil Engineers was delivered on May 5 by Prof. R. V. Southwell, who took as the subject of his address—"Aeronautical Progress, 1914 to 1930". This was the first opportunity the Institution has had for viewing in perspective the extraordinary advances which have been made in aerial locomotion since the period prior to the War; and was all the more apt since the last lecture dealing with the subject was given by Dr. Lanchester in May 1914, to an audience ignorant of what the future held in store for it. Prof. Southwell stressed the remarkable fact that the kernel of all we yet know of fundamental aerodynamic theory was to be read in the 1914 lecture by such as could understand. Dr. Lanchester had been at great pains to give estimates of the gains that might be expected to accrue from improved design in speed, range, etc., and while his forecast of the rate of future progress has naturally been surpassed by actual achievement under the accelerating influence of the War, Prof. Southwell insisted that he could find no direction in which he underrated what was practicable, with the possible exception of the internal combustion engine. This view was supported by a brief summary of the progress made during the last sixteen years. Turning to some theoretical aspects of the subject, Prof. Southwell praised the influence which the Advisory Committee for Aeronautics has exerted both on the industry and in the direction of scientific research under the guiding wisdom of Sir Richard Glazebrook. It seems remarkable that this new wing should have so organised itself as to provide a continuous channel between pure scientific research and its direct application to industry when so many fields of industrial development of much older date have not yet succeeded in establishing anything like this continuity. The remaining part of Prof. Southwell's lecture was taken up with a critical scrutiny of the more modern developments on the theoretical side,

stressing in conclusion that there are many lessons to be learned by older branches of engineering from the newer progress, by those who are prepared to translate the new developments into the language of the non-aeronautical engineer.

DR. FAY-COOPER COLES, retiring vice-president and chairman of Section H of the American Association for the Advancement of Science, in his address at the meeting held in December last at Des Moines, paid a warm tribute to the educational system for natives established by the British in the former German territory of Tanganyika. The subject of the address, which is printed in *Science* for Mar. 7, was the relation of anthropology to Indian and immigrant affairs—a subject upon which Dr. Coles is peculiarly competent to speak in virtue of his residence of four years among the natives of the Philippines while collecting and recording information on behalf of his museum. The reference to the work of the British was quoted to afford a contrast with the methods adopted by the American administration in dealing with Indian affairs. It was pointed out that the United States has at its disposal a mine of information and a great research organisation, yet instead of having the most advanced native policy in the world, Indian affairs are under the control of a Board of Commissioners, few of whom have been recognised as authorities on Indian life and customs, while the Indian Office has often been entrusted to men ignorant of and indifferent to Indian custom. He referred to ill-advised attempts to suppress Indian rites instead of moulding them gradually so as to bring about the adaptation of the Indians to modern civilisation as is being done in the case of the natives under British rule. Dr. Coles also referred to the practical value of anthropology in relation to immigration. Now that immigrants are drawn predominantly from the south and east of Europe rather than the north-west, anthropological studies would afford that knowledge of the cultural background of the incoming peoples which is essential if their absorption into the State is to be facilitated and they are to be prevented from consolidating into compact communities perpetuating the Old World feuds and customs which, in present conditions, delay their participation in American life.

At a recent meeting of the Geological Society of America, Col. Lawrence Martin, chief of the Division of Maps at the Library of Congress, announced that two consultants, in geology and geography respectively, have been added to the Library services. The specialists at the Library, termed consultants, as distinguished from the incumbents of the several 'chairs', have lately been increased for a period by a grant from the General Education Board which, by providing small honoraria, has enabled six such specialists to be added to the service. The essential difference between the incumbents of 'chairs' and the research consultants is that the former are engaged in the administration of divisions of the Library of Congress, as well as in the interpretation of the materials under their custody, while the consultants serve in a purely individual and advisory capacity, rendering counsel in response to suggestions and inquiries, by visit or

by correspondence. The geologist and the geographer who, for part of the present year, are to be associated with this advisory service as consultants are Prof. A. C. Lane of Tufts College, Mass., who will come within the group provided by the grant of the General Education Board, and Prof. A. P. Brigham of Colgate University, Hamilton, N.Y., whose service, however, will be purely honorary. This consultant service is purely experimental; its continuance depends on the use made of it.

In the British Broadcasting Company's regional scheme, five twin radio transmitting stations are to be constructed, each of which will be capable of radiating simultaneously two programmes on different wavelengths. The five centres will be located in Scotland, North England (industrial), London and south-east England, the Midlands, and the south-west of England. The Midlands station at Daventry and the London station at Brookmans Park, are already in operation. In a paper read to the Institution of Electrical Engineers on May 7, P. P. Eckersley and N. Ashbridge gave some of the considerations which led to the choice of these sites, and gave also a detailed description of the Brookmans Park broadcasting station. In choosing this site, account had to be taken of the fact that for several years listeners in the neighbourhood of London had been accustomed to listen from a two-kilowatt transmitter in Oxford Street. To erect a fifty-kilowatt transmitter on the same site would produce an intolerable 'wipe out'. If they had chosen a site eastwards on the Thames estuary much of the service area would have been over the North Sea. In a southerly direction the erection of masts on the top of the North Downs, which would have been a good site, was prevented by civil aviation regulations. The site finally chosen lies on the east side of the Great North Road, on the London side of Hatfield. It is in the centre of a flat field 34 acres in extent. Diesel engines are used to produce the 500 kilowatts required, and very special precautions have been taken to prevent a break-down as continuity of supply is essential. If any essential valve breaks down, it can be replaced in about fifteen seconds.

THE raw materials required by the Osram Works at Hammersmith come from all parts of the world. In an article in the General Electric Company's bulletin for February, an interesting account is given of the materials used for Osram lamps. The metal tungsten from which the filaments are made is obtained from scheelite, a whitish-yellow stone of rough texture which is found in north-eastern Australia. In its rough state it is shipped round the Cape of Good Hope to London, where in the Osram works it undergoes the processes of crushing, grinding, washing, acid treatment, and heating. The final result is the fine and very heavy black powder, which is pure tungsten. It is then pressed, hammered, and drawn into the familiar lamp filament. Shellac, which is one of the essential ingredients forming the cement which attaches the lamp cap to the glass bulb, comes from India. The insects which form it breed in countless numbers in the valley of the Ganges.

They absorb the flowing sap from young shoots of young trees and then exude a resinous secretion over their whole bodies. The twigs bearing the insects are gathered and from them commercial shellac is produced. The nickel and copper used in the special leading-in wires which conduct the current in and out the lamp bulb come from Canada. The tin for solder comes from Malay. The sand, soda, and lime used for making the glass of the bulbs is got in England, and so also is the minute amount of iron which helps to make the alloy used for the leading-in wires. The diamonds used for the dies through which the filaments are drawn come from South Africa. The sources of all the raw materials required for the manufacture of the electric lamps lie in British territory.

In our columns of Oct. 19, 1929, p. 629, mention was made of the fact that the Imperial Agricultural Research Conference had recommended that the Low Temperature Research Station at Cambridge should issue from time to time lists of elaborated titles of useful publications in the field of food investigation and a brief review of the first of these lists was given. We have now received the second part of the first volume of this index (Department of Scientific and Industrial Research. Index to the Literature of Food Investigation. Vol. 1, No. 2, September 1929. Compiled by Agnes Elisabeth Glennie. Pp. iv + 154. London: H.M. Stationery Office, 1930. 2s. net). The arrangement of the sections and subsections is similar to that in the previous part. It is proposed to include in the first number of each annual volume a brief review of the previous year's progress in the subject of food investigation. This bibliography should be extremely useful to all workers on the production and preservation of different articles of food, by putting them in touch with work being carried out in other countries than their own.

THE restoration of Avicé's cottages to form the Portland Island Museum has been completed, and we learn from a communication from Mr. H. J. Sansom and Dr. Marie C. Stopes, honorary secretary and honorary curator, respectively, of the Museum, on behalf of the Museum Committee, that all the expenses of restoration have been fully paid up. The Museum is now ready to receive antiquities and specimens associated with Portland. Particularly welcome would be old prints and maps of Portland; books containing references to Portland, either scientific, historical, or purely literary; well authenticated furniture, coins, etc.; pre-historic remains and fossils found in Portland; preserved specimens of the existing flora and fauna; photographs of famous buildings built of Portland stone; legends, folk songs, song-games, old customs, etc., written down by Portland folk. Glass-fronted display cases are wanted and also money for an equipment fund. As the building is now ready, it is hoped to hold the opening ceremony during the last week in July of this year. Specimens and exhibits should if possible be accompanied by a letter giving the fullest available information about each, and should be addressed to the Portland Island

Museum, c/o Mr. H. J. Sansom, Pennsylvania Castle, Portland.

THERE has been in the past some little confusion in regard to methods of specifying access of daylight into buildings. The method adopted is based on the use of either of two factors, the 'daylight factor', which is the ratio of the internal illumination to the illumination of a horizontal surface exposed to a hemisphere of sky, and the 'sill ratio', which is the ratio of the internal illumination to the illumination of a horizontal surface exposed to half a hemisphere of sky (as is the case for a surface resting on the window-sill). The second of these factors is necessarily double the first. In the series of papers, technical papers on illumination research, issued by the Department of Scientific and Industrial Research, it was intended to use the sill ratio. In 1928, however, international agreement to make use of the daylight factor was attained, and accordingly this method is to be used in all future publications of the Illumination Research Committee. The only existing publications of the Committee in which values of the sill ratio are employed are those on "The Natural Lighting of Picture Galleries" (No. 6) and "The Penetration of Daylight and Sunlight into Buildings" (No. 7). In both cases the values should be halved so as to express them in terms of the 'daylight factor'.

Two discoveries of special interest in the anthropological field are recorded in the recently published Report of the National Museum of Canada for 1928. Dr. J. Wintemberg has found a camping site of the extinct Beothuk Indians on the north side of Belle Isle, and a camping ground of the Iroquois near Kegashka. Both discoveries add to the territory known to have been ranged by these tribes. The interesting tribes of the Beothuk, who formerly lived in Newfoundland but have long been extinct, are thus shown once to have occupied the east corner of Labrador, a fact not hitherto known, while the Iroquois discovery is several hundred miles east of the known range of their forays. Although these are the most interesting of the discoveries made by the museum staff in the field during the year, excellent work was done by other expeditions. Dr. Harlan I. Smith was collecting archaeological and ethnological specimens in British Columbia and taking motion pictures of the Salish, Blackfoot, and Cootenay Indians; Mr. C. M. Barbeau was studying French Canadian arts and crafts in Quebec; Dr. J. C. Boileau Grant conducted anthropological investigations on Cree and Chippewyan Indians on Lake Athabasca; and Mr. C. B. Osgood travelled on the Mackenzie River, where he wintered with a band of Hare Indians on Great Bear Lake.

THE late Mr. J. D. Logan presented to the trustees of the National Botanic Gardens at Kirstenbosch, South Africa, forty acres of land near Matjesfontein in the Western Karroo, where the interesting succulents in which the Karroo is so amazingly rich may be cultivated under natural conditions. Prof. R. H. Compton, director of the Kirstenbosch Gardens, has a brief article upon this interesting garden experiment

in the *Kew Bulletin*, No. 2, for 1930. This Whitehill Garden was seen by many of the visiting botanists during the recent meeting of the British Association and much interest was aroused. The district is extraordinarily rich in species; Prof. Compton has collected approximately 400 species of flowering plants and ferns in the garden itself, or on Karroo rocks in the immediate vicinity. With a winter rainfall which probably averages only 5 inches per annum, these plants include a number of the striking succulents for which this region of the Karroo is famous. The area was enclosed by a goat-proof fence when first selected in 1920, but it was only in 1925 that it was possible to appoint a curator. The gardens are financed entirely from private subscriptions and no public body makes any contribution to its support. As Prof. Compton says, therefore . . . "progress is slow and the future precarious", but the plants in this garden are so extraordinarily interesting that it is earnestly to be hoped that this uniquely interesting experiment in botanical gardening will prove a permanent success.

At the anniversary meeting of the Royal Society of South Africa, held on Mar. 19, the following officers were elected: *President*, Dr. W. A. Jolly; *Honorary Treasurer*, Dr. L. Crawford; *Honorary General Secretary*, Dr. B. F. J. Schonland.

THE Secretary of State for the Colonies has made the following appointments in the Colonial Agricultural Services: Mr. A. E. Haarer, district agricultural officer, Tanganyika Territory, to be agricultural lecturer, Tanganyika Territory; Mr. A. B. Harper, to be produce inspector, Nigeria.

It is announced in *Science* that the Rumford Premium of the American Academy of Arts and Sciences was presented on April 9 to Dr. John S. Plaskett, director of the Dominion Astrophysical Observatory, Victoria, B.C., in recognition of his researches on stellar spectroscopy.

A DISCUSSION on magnetism is to be held by the Physical Society on Friday, May 23, at the Imperial College of Science, Imperial Institute Road, South Kensington, S.W.7. The meeting will consist of two sessions, 3.4.30 p.m. and 5.15-7 p.m., and the discussion will be opened by Sir Alfred Ewing, with a contribution on "Ferro-Magnetism and Hysteresis". Other contributors to the discussion include Dr. E. C. Stoner, Prof. H. S. Allen, Prof. C. G. Darwin, Mr. W. Sucksmith, Mr. F. C. Powell, Prof. W. Peddie, Prof. P. Weiss and Dr. R. Ferrer, Prof. W. Gerlach, Dr. P. Kapitza, Dr. W. L. Webster, and Dr. L. F. Bates. Admission is free without ticket.

MR. R. A. WATSON WATT, writing from Datchet, points out that the note in *NATURE* of May 10, p. 717, on halo phenomena of May 1, did not refer to the really rare occurrence of the halo of 46°. He adds: "About 17 h. G.M.T. on May 1 I saw from Datchet the 22° halo, two exceptionally brilliant mock suns, with short arcs of the mock sun ring, and the upper two-thirds of the 46° halo, which was more brilliant and more definitely coloured than on any other of the three or four occasions on which I have seen it".

WE much regret to announce the death on May 13, at sixty-eight years of age, of Dr. Fridtjof Nansen, the distinguished Arctic explorer and naturalist.

At a general meeting of the members of the Royal Institution, held on May 5, it was announced that the Managers had received and accepted from the Trustees of the Rockefeller Foundation an offer of a donation of £20,000 for endowment of research in the Davy Faraday Laboratory, on condition that the sum of £50,000 for the same purpose should be secured by the Royal Institution from other sources before June 30, 1933; with an additional payment of £1000 per annum up to a total of £3000 for maintenance of research in the Laboratory until such time as the capital payment should be made. The thanks of the members were returned to the Trustees of the Rockefeller Foundation for their generous proposal.

THE Second International Congress for Sex Research will be held in London in the house of the British Medical Association, Tavistock Square, on Aug. 3-9. Among the subjects to be discussed at the general meetings are: puberty and maturity; physiology of the sex glands; hormone therapy. Membership is restricted to professional biologists engaged in research on, or teaching in accredited institutions, anatomy, anthropology, botany, medicine, physiology, psychology, sociology, veterinary science, or zoology: and to members of the medical profession. Those wishing to take part in the Congress should apply to the Congress Secretary, Department of Animal Genetics, King's Buildings, The University, Edinburgh.

THE Council of the Royal Society of Edinburgh has made the following awards: Keith Prize for the period 1927-29, to Dr. Christina C. Miller, for her papers on the slow oxidation of phosphorus trioxide, published in the *Proceedings* within the period of the award, and in consideration of subsequent developments on slow oxidation of phosphorus, published elsewhere; Neill Prize for the period 1927-29, to Prof. E. B. Bailey, in recognition of his valuable contributions to the geology of Scotland, two of which have recently appeared in the *Transactions* of the Society under the titles of (1) "Perthshire Tectonics: Loch Tummel, Blair Atholl, and Glen Shee", and (2) "Schist Geology: Braemar, Glen Cluny, and Glen Shee"; James Scott Prize for the period 1927-30, to Prof. Niels Bohr, who will deliver an address, in terms of the award, on May 26 next.

A CHANGE has recently been made in the administration of the one-time Laura Spelman Memorial Fellowships. A Social Science Research Training Committee, under the chairmanship of Sir Josiah Stamp, has been in existence for two years, awarding scholarships intended to encourage quantitative and exact treatment of social and economic problems. This Committee has now been merged for purposes of advice in the field of economics with the Fellowship Advisory Committee of the Rockefeller Foundation for the Social Services in Great Britain and Ireland. Applications for fellowships should come, in all cases, not from candidates themselves but from a competent academic or other authority familiar with the candi-

date's qualifications. All correspondence should be addressed to the secretary of the Committee, Mr. N. F. Hall, University College, Gower Street, London, W.C.1.

WHEN the Society of Glass Technology, which has its headquarters in the Department of Glass Technology of the University of Sheffield, visited Aachen in May 1928 to hold a joint meeting with the Deutsche Glastechnische Gesellschaft, an invitation was given to the German society to pay a return visit to England. The invitation has been accepted and the return visit will take place on May 26-June 3 next. The party is expected to number about sixty. Social functions and visits to works and laboratories have been arranged, starting at Sheffield, and including Chesterfield, Castleford, Knottingley, St. Helens, Stourbridge, and London. June 2 will be devoted to joint meetings of technical committees of the two societies. On June 3 joint general meetings will be held at the Institution of Mechanical Engineers, London, at which all interested will be welcome.

THE retirement of Prof. H. F. Newall from the chair of astrophysics at Cambridge, which he occupied from its creation in 1909 until last year, provided an opportunity for recognising in a suitable way his great services to astrophysics, and it was agreed by a large body of subscribers that a portrait of Prof. Newall be presented to the University to commemorate the founder of this new and active department of astronomical research at Cambridge. On Saturday last, May 10, in the Master's Lodge of Trinity College, the portrait, painted by Mr. Fiddes Watt, was presented by Sir J. J. Thomson to the University and accepted by the Vice-Chancellor (the Master of Magdalene College). Sir Frank Dyson, the Master of Trinity College, the Vice-Chancellor, and Sir Joseph Larmor spoke warmly of Prof. Newall's work, and Prof. Newall acknowledged the kindness of the subscribers both in England and abroad. The portrait is to be hung in the director's room of the Solar Physics Observatory.

A VERY complete summary and survey of the hospital service in the United States is given in the *Journal of the American Medical Association* for Mar. 29 (vol. 94, No. 13, pp. 921-991). The total capacity of all hospitals and sanatoriums is given as 907,133 beds and 47,939 bassinets, and it is suggested that there is an over-supply of general hospitals. Data are given of the staffing, laboratories, X-ray departments, number of beds, and average patients per bed, and also of approved clinical laboratory service.

A VOLUME of 'collected' papers, 48 in number, by members of the staff of the London Hospital and Medical School, has been issued under the title "Researches published from the Wards and Laboratories of the London Hospital during 1929" (London: H. K. Lewis and Co., Ltd., 7s. 6d. net), all of which have appeared in current journals and transactions. A wide range of subjects is dealt with—clinical medicine and surgery, bio-chemistry and physics, physiology, pathology and bacteriology, and zoology. Some of the papers are of much interest and importance, particularly one by Dr. Donald Hunter recording

a case of over-function of the parathyroid gland caused by a parathyroid tumour, with rapid restoration to health on its removal. The volume is issued by a 'selection committee', of which Mr. Hugh Cairns is honorary secretary.

MESSRS. Dulau and Co., Ltd., have just issued a catalogue (No. 176) of upwards of 700 second-hand works on botany and horticulture. Copies of the catalogue can be obtained free upon application.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:—A principal of the Government Technical Continuation and Commercial School, Kingston, Jamaica—The Secretary, Board of Education, Whitehall, S.W.1, or, for Scottish candidates, The Secretary, Scottish Education Department, Whitehall, S.W.1 (May 24). An analytical chemist under the Marine Biological Association of the United Kingdom—The Director, Marine Biological Laboratory, Plymouth (May 27). A technical officer in the Admiralty Technical Pool, with experience in the design of telephones, bells, buzzers, and similar electrical instruments used in low-power signalling systems—The Secretary of the Admiralty (C.E. Branch), Whitehall, S.W.1 (May 27). An assistant lecturer in political science at the London School of Economics and Political Science—The Secretary, London School of Economics, Houghton

Street, Aldwych, W.C.2 (May 29). An assistant lecturer in biology at University College, Nottingham—The Registrar, University College, Nottingham (May 29). A lecturer-in-charge, with training in engineering and workshop practice, for branch of the Witwatersrand Technical College, near Johannesburg—Chalmers and Guthrie (Merchants), Ltd., 9 Idol Lane, E.C.3 (May 31). A sanitary inspector under the Sudan Medical Service—The Controller, Sudan Government London Office, Wellington House, Buckingham Gate, S.W.1. A principal of the proposed Department of Business Administration at the London School of Economics—F. W. Lawe, 44 Hans Crescent, S.W.1. A lecturer on hygiene and physical training at the Training College, Truro—The Principal, Training College, Truro. A chief lecturer in the electrical engineering section of the engineering department of the Halifax Municipal Technical College—The Principal, Municipal Technical College, Halifax. A full-time lecturer in mining and engineering subjects at the County Technical College, Mansfield—The Principal, County Technical College, Mansfield. An assistant chemist at the South Eastern Agricultural College, mainly for arsenic estimation by the electrolytic method—The Secretary, South Eastern Agricultural College, Wye, Kent. A zoologist and an algologist at the Port Erin Marine Biological Station—The Registrar, The University, Liverpool.

Our Astronomical Column.

Conjunction of the Planets Venus and Jupiter.—An interesting spectacle for the naked eye will be provided by the conjunction of the planets Venus and Jupiter on May 17. The nearest approach of the two bodies will occur at 7 P.M. when their distance apart will be only $1\frac{1}{4}^{\circ}$. This will, however, be nearly two hours before sunset. The two planets will set at about 11 o'clock (Summer Time) and should offer an interesting configuration during about an hour and a half preceding that time. The higher object of the pair will be Venus, which will be a little above and to the left of Jupiter. This will provide an excellent occasion on which to estimate the difference of colour and magnitude of the two orbs.

Comet 1927d.—M. Ebell gives the following elements of this comet in *B.Z.* No. 21:

T	1930 June 12-7904 U.T.
ω	$187^{\circ} 20.13$
Ω	$81 27.11$ } 1930.0
i	$20 24.44$ }
$\log q$	0.01283

Ephemeris for 0^{h} :

	R.A.	N. Decl.
May 16	$16^{\text{h}} 59^{\text{m}} 43^{\text{s}}$	$37^{\circ} 18'$
20	$17 31 6$	$36 27$
24	$18 15 37$	$33 56$
28	$19 17 52$	$27 54$

The comet is approaching both sun and earth, so is likely to become brighter. It is only $8\frac{1}{2}$ million miles from the earth on June 3.

The Lowell Planet.—Prof. Stroobant has found an image on the plates taken at Uccle Observatory in 1927 which very probably belongs to the Lowell planet. He is fairly certain that it is a heavenly body,

not a flaw on the plate, and it falls accurately on the trajectory of the planet.

The position is as follows for the equinox of 1927.0: 1927 Jan. $27^{\text{d}} 21^{\text{h}} 27^{\text{m}} 41^{\text{s}}$ U.T.; R.A. $7^{\text{h}} 1^{\text{m}} 59.7^{\text{s}}$; N. Decl. $21^{\circ} 17' 59.5''$; magnitude, 15 to 15.5.

On comparing this position with those computed from the two parabolas deduced by Prof. Banachiewicz and Dr. C. H. Smiley, it is found to lie 0.7 of the way from the receding parabola to the approaching one, the separate ratios being 0.695 from the R.A., 0.714 from the Decl.; the former has three times the weight of the latter. Hence, if the identification is correct, the body is approaching the sun, and the eccentricity may be estimated as about 0.4. The observations in 1930 favoured *recession* rather than *approach*, but the observed arc was not long enough to settle the question.

'Wolf's Numbers' for 1929.—No. 122 of *Astronomische Mitteilungen* contains the counts of sunspots, made during the year 1929 by 55 observers at various stations, from which the Wolf, or relative sunspot, numbers are deduced. Tables are given for (1) daily values for the sun's whole disc, (2) daily values for a central zone the diameter of which equals half that of the disc, (3) monthly values for the whole disc. The 'number' deduced for the year 1929 is 65.0; the corresponding values for the years 1923–28 inclusive are—5.8, 16.7, 44.3, 63.9, 69.0, 77.8. Table 3 shows that the least active month of 1929 was September (34.4), and the most active, December (108.0). On no day of the year was the sun free from spots. Advance data, corresponding to those given in Tables 1 and 2 of the above publication, are included in the quarterly circulars issued from Zurich by Prof. Brunner under the auspices of the International Astronomical Union.

Research Items.

Chumash Prehistory.—In 1927 and 1928, Mr. Ronald L. Olson spent some weeks excavating in the neighbourhood of Santa Barbara, California, and on Santa Cruz Island. The more important finds are reviewed and comparison between the sites of the two areas made in vol. 28, No. 1, of the *University of California Publications in American Archaeology and Ethnology*. In both cases difficulty was experienced in finding burials that had not previously been rifled by relic hunters. The sites on the area facing the ocean front are of the familiar shell-mound and kitchen midden type, varying in size from an insignificant scattering of a few thousand fragments up to deposits twenty feet thick. On the islands the sites are larger and more abundant. It is probable that they were occupied only seasonally and not all the year round. In all the mounds there is a progressive diminution in number of objects as the bottom of the mound material is approached, especially noticeable in the bottom two feet. This is due mainly to a decrease in shell and bone objects. Differences in pattern and style in the objects are scarcely noticeable. Mortars, pestles, metatés and mullers, flint work, fish hooks, and barbs and ornaments, if present at the various levels, show uniformity throughout. One mainland site, however, showed that there was a change in the prevailing method of grinding when the lower strata were laid down; metaté and muller were used almost exclusively, but later gave way to mortar and pestle. Post-European objects were found on these sites. It is probable that shell heaps yielding metatés and mullers are the oldest. The stratigraphical evidence points to (1) An early mainland period; (2) An intermediate mainland period; (3) A late mainland period. On the islands an early island period equates with the last phase of the early mainland and the beginning of the intermediate. A late island period occurs in which European objects are found. The sites yielded no evidence of oceanic contact, though canoes and circular shell fish-hooks were found.

Human 'Missing Links'.—In the Smithsonian Report for 1928, Gerrit S. Muller deals with this topic as illustrated by *Pithecanthropus erectus* and *Eoanthropus dawsoni*. The author commences by giving a general statement of the question at the present time, and points out that there is a considerable divergence of opinion on the subject. The two types are essentially different in that the *Pithecanthropus* remains consisted of an ape-like skullcap, ape-like teeth, and a man-like femur, while *Eoanthropus* furnished a man-like brain case, man-like teeth, but an ape-like lower jaw. He then discusses whether an agreement on the position of the two forms is possible. Instead of giving an answer, he takes each type in detail and gives a full summary of all the published opinions on the various different points in connexion with them. The paper is illustrated by photographs of all the actual remains or casts thereof without any attempts at reconstructions. Perhaps the most valuable part of the paper is a complete bibliography of all the memoirs or articles in which the two forms have been discussed.

Special Skin Affections Due to Common Plants.—It is probably common knowledge that some persons are especially sensitive to a substance contained in the little glandular hairs upon the Japanese primula, and through contact with this plant may develop a painful inflammation of the skin, which may last for months, or even years, unless the cause is rightly diagnosed and appropriate treatment employed. An article by K. Touton, of Wiesbaden, in *Die Naturwissenschaften* for Feb. 7, 1930, enumerates an astonishing number

of less well-known cases of skin affections which have been traced in a similar way to the special sensitivity of the victims to the particular plants. In some cases, of course, prolonged exposure to the causal conditions may be necessary, as in the yellow colour of the skin, due to deposition of carotin, produced by continued indulgence in oranges, or the skin affection in the left hand sometimes occurring in the orangeries amongst the orange pickers. The author concludes his account of a long list of skin troubles caused by various familiar cultivated plants with the suggestion that on another occasion he may direct attention to some forty other plants, with which man comes frequently into contact, which have also been proved to exert a stimulating effect upon the human skin in some cases.

The Basis of Colour Changes in Animals.—Prof. G. H. Parker has published a useful summary of the state of knowledge concerning chromatophores (*Biol. Rev. and Biol. Proc. Cambridge Phil. Soc.*, vol. 5, p. 59; 1930). Active colour changes in animals are conspicuously developed only in the cephalopods, the crustaceans, and the cold-blooded vertebrates, and in each group a distinctive type of chromatophore has arisen. All these animals have well-developed eyes, and it would seem that in all these groups the eye plays a most important part in initiating the colour changes. But it is no direct reaction, for even in highly organised instances the chromatophoral responses partake of the nature of a reflex rather than of a higher nervous response, and must be regarded as indicating a reactive capacity of relatively low order. The colour responses may be excited through the direct stimulation of chromatophores by external influences, through hormones, or through nervous impulses, but the first is the least common of these modes. Although the biological significance of the chromatophore systems in animals is by no means obvious, it seems certain that in many creatures they are utilised in developing protective or aggressive coloration, while in others they play an important part in behaviour during the breeding season, in heat regulation, and in other such subsidiary functions. These views, however, await experimental confirmation.

Rattlesnakes of the Western United States.—Scale counts and comparative measurements made on well over a thousand specimens of rattlesnakes from most of the western States and northern Mexico, have led Laurence M. Klauber to revise the relationships of species and subspecies in that region (*Trans. S. Diego Soc. Nat. Hist.*, vol. 6, No. 3, p. 95; 1930). The general tendency of his investigation is to show that these areas are peopled by a series, seven in number, of subspecies of *Crotalus confluentus*, and that California and Nevada forms hitherto ranked with the tiger rattlesnake (*C. tigris*), also belong to *confluentus* as connecting links. One result of the new ranging of subspecies is that in certain cases two subspecies of the same species have overlapping areas of distribution without showing any intergrading forms. By some, such a condition is supposed to be impossible, but the author does not see why it should not occur, and thinks that overlapping of conspecific forms is most likely to occur in regions, such as that west of the Rockies, relatively contorted both topographically and climatically.

Philippine Camphor.—In the *Philippine Journal of Science*, Vol. 41, No. 2, February 1930, Augustus P. West and H. Taguibao give the result of the examina-

tion of young trees of the laurel camphor, *Cinnamomum camphora*, which have been planted by the Philippine Bureau of Forestry since 1910, with seeds obtained from Japan. In Formosa and Japan the bulk of the crystalline camphor is obtained by a crude process of distillation from the wet wood of old trees, the leaves containing mainly camphor oil. In these young trees in the Philippines, very little camphor was found in the wood, but the leaves yielded 2-7 per cent on the dry weight. The authors point out that some of the trees examined contained practically no crystalline camphor in the leaves, but these trees yielded a laevo-rotatory camphor oil distinct from the camphor oil of commerce, which is dextro-rotatory and occurs along with the crystalline camphor. The authors discuss the possibility of obtaining supplies of camphor from the Philippine trees able to compete with the synthetic product made from the pine tree turpentine, which contains usually about 70 per cent pinene. They point out also that the Philippine pines (*Pinus insularis*) may be a valuable source of this synthetic competitor, as they appear to yield a turpentine rich in pinene.

Hybridisation in the British Flora.—Messrs. E. M. Marsden-Jones and W. B. Turrill, of the staff of the Herbarium, Kew, have a very clear note on this subject in the *Gardeners' Chronicle*, Mar. 15. Their general conclusion, based on taxonomic observation and breeding experiments with common plants of the British flora, is that "hybridization is one, but only one, of the factors of organic evolution". They describe the origin of a tetraploid hybrid, a 'culti-species' which breeds true, by crossing under controlled conditions *Saxifraga rosacea* with *S. granulata*. The same hybrid has been recorded as occurring naturally on the Continent. They compare the behaviour of the two genera *Silene* and *Centaurea*. In *Silene* natural hybridisation, effective in maintaining new forms, seems to occur only within the species, amongst the various forms included in this taxonomic group. The two species *S. maritima* and *S. vulgaris* will cross readily and do hybridise in Nature, but the resultant hybrid forms seem to have no permanence in Nature and are only found in limited regions where the habitats of the two species overlap. In *Centaurea*, on the other hand, in the 'nigra' group, hybridisation between certain taxonomic species is extremely frequent and seems to be responsible for the existence of a large number of these taxonomic units, which are either hybrids, segregates, or the results of back-crosses to one parent. The authors conclude definitely that the chief cause of polymorphism among the British knapweeds is hybridisation and that plants considered as distinct species by a specialist on the genus are hybrids. The distinction between this inter-specific hybridisation in *Centaurea* and the intra-specific hybridisation in *Silene* obviously cannot be over-stressed, as it depends, in part, upon the relative extent to which specific analysis has been applied by the taxonomist within a group of allied forms in two different genera.

A New Ordovician Gastropod.—With great difficulty sufficient material has been obtained by Mr. E. Kirk to justify the description of a new Ordovician gastropod from the Great Basin region of Nevada (*Proc. U.S. Nat. Mus.*, vol. 76, art. 22). *Mitrospira longwelli*, n. gen. et sp., is highly characteristic of a fairly narrow zone in the upper portion of the Pogonip beds. Despite its sinistral aspect, the author gives reasons for considering it to be an extreme hyperstrophic example of a dextral shell allied to *Maclurites*, for one species of that genus in the Pogonip at times shows a slight eversion of the whorls giving a slightly convex outline

to the lower surface. So far, no antecedent form to *Mitrospira* has been met with and the only other known gastropod with which it may be compared is *Palliseria*, Wilson. An interesting feature shown by vertical sections is that the apical whorls were progressively filled with secondary deposits of lime during the life of the animal, very similar to that which occurs in certain species of *Natica*.

The Tango (Japan) Earthquake of Mar. 7, 1927.—Although the Tango earthquake of 1927 has been more closely studied than perhaps any other earthquake, Prof. S. Nakamura has added some interesting facts in a paper recently translated into English (*Science Repts. of the Tôhoku Imp. Univ.*, vol. 18, pp. 419-472; 1929). The two faults along which displacements occurred have been described in these pages (*NATURE*, vol. 122, p. 36). The author visited the Japan Sea coast ten days after the earthquake. The previous sea-level was well marked by lines of living shell-fish and sea-weeds, showing that the coast had been elevated from a point $1\frac{1}{4}$ miles east of the seaward end of the Gomura fault to a point about 7 miles to the west of it. The maximum uplift, of 2 feet, occurred about the middle of this distance. Some idea of the intensity of the shock is given by the maximum acceleration of 4500 mm. per sec. per sec. at Mineyama, a town almost completely destroyed by the earthquake. Many observations on the rotation of objects were made, and it was found that the anti-clockwise rotation prevailed near the Yamada fault and the clockwise rotation near the Gomura fault. The shear along the former fault was clockwise and along the latter anti-clockwise.

Climatic Changes in Central Asia.—The theory of the progressive desiccation of western Central Asia has been supported by Sir Aurel Stein, Prof. E. Huntington and others who have examined the evidence on the spot. It has, however, been rejected by other travellers, including Dr. Sven Hedin and Prof. J. W. Gregory. In a paper in the *Geographical Journal* for April, Lieut.-Col. R. C. F. Schomberg discusses the climatic conditions in the Tarim basin, and comes to the conclusion that changes in aridity and distribution of population have been caused not by climatic changes but by natural deviations in the course of streams. The soft friable nature of the soil lets stream courses change easily. Any slight increase in the volume of a stream may throw it off its course and mean the abandonment to aridity of large areas. Again, a river cutting downwards tends to be impeded and so diverted by its banks caving in. The abandonment of cultivation may be caused not only by a river changing its course, but also by the level of the water falling, as the bed is cut downwards, and becoming too low to be available for convenient irrigation. Col. Schomberg discusses also the value of evidence obtained by the existence of dead tamarisk and other trees which have often been cited as evidence of weather conditions in the past. He finds this evidence somewhat perplexing, since at times a luxuriant growth of new tamarisk occurs side by side with many dead bushes.

Absorption of Sound.—When standing waves are set up in a pipe having a source of sound at one end, and a reflecting diaphragm at the other, the relative amplitudes of the changes of pressure at nodes and antinodes will be determined by the extent to which the energy reaching the diaphragm is thrown back into the pipe. Some measurements of the absorption coefficients of a number of materials by this method are described by A. H. Davis and E. J. Evans in the

April number of the *Proceedings of the Royal Society*. A loud speaker was used as the source of sound, and the standing waves set up in an iron tube 30 cm. in diameter and 250 cm. long, the end of which was closed by a steel disc supporting the test specimen in a wooden ring. The change of pressure through the tube was found by means of a second smaller tube, connected to an external electrical registering system. The materials investigated were mostly those which are fairly good absorbers of sound, and records were obtained of the effects of the thickness of material and method of mounting, as well as of the effect of variation of the frequency of the sound. The important consequences which may accompany a change in the state of a specimen are well illustrated by some results given for a cane fibre board 1.1 cm. thick. For a frequency of 1200 cycles per second it was found that the ratio of the absorbed energy to the incident energy was 0.07; when the board was drilled with 480 holes per square foot, each hole being $5/32$ inch in diameter, this ratio was increased to 0.53.

Jet-Wave Rectifiers.—In a paper read to the British Association at Leeds in 1927, Prof. Jul. Hartmann described a jet-wave rectifier he had invented for converting alternating current into direct current. The alternating current flows along a thin jet of falling mercury which is put into synchronous oscillation with the current. The end of the jet makes connexion alternately with two contact pieces connected with the opposite ends of a transformer winding. The positive pole of the direct current is taken from the middle point of the transformer winding and the negative pole from the nozzle end of the jet. The rectified current in the jet wave can be quite large, as mercury is a conductor. The jet is cut by a tungsten knife placed between the two contact pieces. The commutation is accompanied by a transient arc, and to reduce the energy losses in the arc was one of the main problems in designing the device. The contact pieces are mounted in a chamber kept filled with hydrogen, because, with the possible exception of helium, this gas is the only one which is able to absorb the energy of the spark in the small time available for this to take place. The duration of the spark in atmospheric air is about ten times as long as its duration in hydrogen. Commercial rectifiers having an output of 200 kilowatts at 550 volts have been developed at the municipal power station of Copenhagen. Experiments were tried on a large scale with a jet-wave rectifier working in parallel with rotary converters. Severe short circuits caused practically all the converters to fall out of action, but the jet-wave rectifier continued to act during the short circuit and afterwards. The author, in his paper to the Institution of Electrical Engineers read on Feb. 13, points out that the jet-wave rectifier provides a means for the production of very high direct current voltages at a reasonable cost. He thinks that a 100-kilowatt direct current rectifier can be made from a hundred very simple jet-wave commutators connected in series.

Machine Telegraph Systems.—Telegraphy and telephony are now comparable, as both can bridge the distance between two points on the earth's surface. The valve amplifier with loaded conductors has done this for telephony, and the regenerative repeater, loaded conductors, and the valve have done it for telegraphy. The paper, therefore, on machine telegraph systems which was read to the Institution of Electrical Engineers by H. H. Harrison on Mar. 27 was a timely one. He pointed out that although inland telegraphy, at least in Europe, is in a bad way financially, international telegraphy is remunerative. In

Europe, inland telegraphy is controlled by government departments, but in America, where it is successful, it is conducted by two privately owned companies. The success, however, is mainly due to the fact that America is a land of long distances. This and other economic factors enable the telegraph not only to survive but also to flourish in spite of the growth of its rival. In Europe, a factor in favour of telegraphy is the difference in local times. As we move eastward, an hour has to be added to the time for every 15° of longitude. It is possible to telephone to America during normal business hours between 2 and 5 p.m. Greenwich time. Talking eastwards must proceed in the morning, commencing at 9 a.m., but it cannot be carried out farther east than China. This difference in local time constitutes the only factor operating against world-wide telephony. The sole effect on telegraphy is to cause a change in the direction of the traffic, which flows eastwards and westwards alternately except when the working days overlap. Either wired or radio telegraphy is bound to survive. The most serious problem that remains to be solved is how to make inland telegraphs pay in countries where distances are comparatively short. The principal obstacle is the cost of retransmission at the various stations, and this will probably be solved by making all these operations automatic.

Turbo-Generator at Hell Gate Station, New York.—There are many advantages in using very large turbine generators in central stations, and it is difficult to see what cause will ultimately limit their size. Working steam pressures are also continuing to increase. A pressure of 1200 pounds per square inch a few years ago was considered quite outside the practical working range. Now it is well established and turbine builders are preparing for the coming of pressures up to 3000 pounds per square inch. More than a year ago, a 165,000 kilowatt, two-unit set was installed by Brown Boveri of Baden in the Hell Gate Station, New York. In size it far outstrips all other electrical apparatus. In the *Westinghouse International* for February, a description of this machine is given. It is 91.5 feet long, 40 feet wide, and rises 27.5 feet from the floor. It weighs 1300 tons, and would light a million homes at once or provide excellent illumination for a highway twice round the world. A notable feature is the high speed of the rotor, which makes 1800 revolutions per minute. Per unit generated it is more compact and cheaper than smaller turbines. The necessary ventilation is provided by three vertical type blower fans which are placed below and between the generators. This effects a considerable saving in the floor space. No less than 275,000 cubic feet of air per minute are supplied to keep the electric generators cool when fully loaded. Further details of this turbine are given in the *Brown Boveri Review* for January.

Chemical Effects of X-rays.—Clark and Pickett, in the February number of the *Journal of the American Chemical Society*, describe the action of X-rays on several chemical systems known to undergo photochemical change in ultra-violet light. Most of the changes, if any, were very small. The most sensitive reactions found besides the oxidation of ferrous to ferric salts were a series of aldehyde-ketone condensations. Colloidal lead used in the Blair Bell technique for cancer therapy was studied from the points of view of preparation, stability, coagulation by X-rays, production of secondary X-rays, and catalytic effects in reactions subject to irradiation. The conclusion was reached that the specific chemical effect rather than the action of producing secondary X-rays *in situ* in the tissues is indicated.

The Snellius Expedition.

By Commander P. M. VAN RIEL, Chief of the Oceanographical Department, Royal Netherlands Meteorological Institute, Leader of the Expedition.

IN view of the lack of knowledge concerning the inland seas between Asia and Australia, the Society for Scientific Researches in the Dutch Colonies and the Royal Dutch Geographical Society at Amsterdam planned an oceanographical, geological, and biological expedition to those parts for the years 1929-30. The field of research, shown on the accompanying chart (Fig. 1), embraces the deep basins in the eastern part of the Dutch colonies with the adjacent regions of the Pacific and the Indian Ocean, which they connect. The area is nearly as large as that of the Mediterranean and the Black Seas combined. The conditions are very different from those in the open ocean and render this part of the Archipelago a region of great interest for oceanographical, geological, and biological work.

In view of these joint interests the scientific staff is composed as follows: an oceanographer-leader, with two oceanographers (one chemical, one physical), a chemist, a geologist, and a biologist. The scientific equipment of the research vessel (*H.M.S. Willebrord Snellius*, a surveying ship of 1200 tons) was transported while she was being built in Holland. By the co-operation of the East Indian Government and the Navy Department at Batavia, this ship is being withheld from her ordinary surveying work and put at the disposal of the expedition for fifteen months. The naval staff is composed of a commander, four naval officers, a naval engineer, a doctor, and a paymaster.

The main purpose of the expedition is to acquire more data concerning the physical and chemical properties of the sea water, the horizontal and vertical circulation in the various layers, the configuration of the bottom and its deposits, and the distribution of the plankton. Moreover, biological and geological investigations ashore and on coral reefs form part of the programme.

The investigations of ocean temperatures, the salinity and the amount of oxygen of the water, the determination of currents by calculation and direct measurements, and the meteorological observations directly connected with oceanography, are in charge of the leader of the expedition, assisted by Dr. H. J. Hardon and Mr. H. C. Hamaker. Commander F. Pinke and his officers and men are responsible for a considerable amount of work, of which echo soundings, the determination of the position of the ship, and laboratory work form the principal part.

The chemical investigations are in charge of Dr. A. B. Boelman. The determinations are to be such as will help and complete the oceanographical, geo-

logical, and biological work, not such as would be of purely chemical interest; hence determinations of salinity, oxygen content, alkalinity, and pH were chosen. The first is only of oceanographical, the second of both biological and geological interest. As already mentioned, these two are under the direct supervision of Dr. Hardon. Alkalinity measurements belong to the geological side, those of the pH to all three together. Up to the time of writing no opportunity had occurred for determinations of the phosphate content. It is hoped that it will be possible to

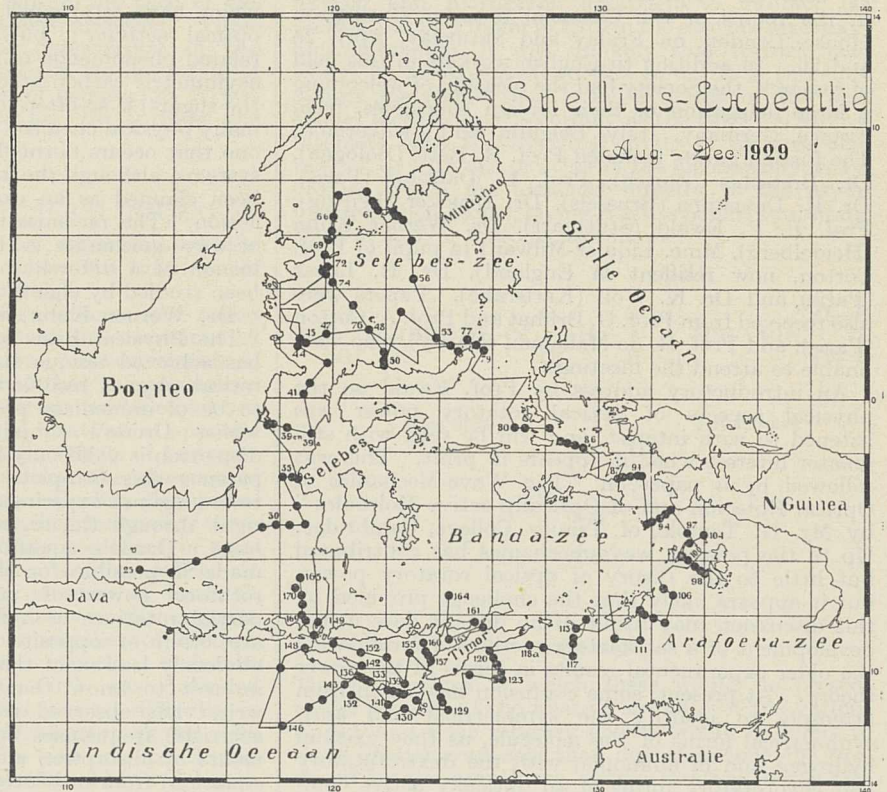


FIG. 1.

make some phosphate determinations in the future, for these, together with quantitative plankton fishing, afford valuable information on the biology of the seas.

Data of importance for geology are obtained by the echo soundings that are made at frequent intervals during the sailing, and by wire soundings with a bottom sampler at each station. Dr. Ph. H. Kuenen, the geologist, is responsible for the latter.

The task of the biologist, Dr. H. Boschma, is confined to investigations which may help to give a better understanding of geological phenomena. At sea the biological work consists of the collection of plankton—surface catches at nearly every station, and, occasionally, catches with closing nets or large tow-nets for macroplankton. Every now and then (twice or thrice a month) a couple of days are spent ashore together with Dr. Kuenen; then collections are made of the animals inhabiting the reefs and the shore. The results of the investigations ashore are mostly of local interest, but these observations

on reefs and reef islands will no doubt prove to be of more general importance when viewed as a whole.

To the small number of existing wire soundings off the shelves many thousands of echo soundings are being added. These will enable us to make corrections on the present depth chart.

The track of the ship during the first five months is plotted on the chart (Fig. 1), the dots representing the position of the stations. In most cases observations have been made along cross-sections of the troughs between the isobaths of 200 m., so as to allow

calculation of currents in various layers by the methods of dynamical oceanography.

Interesting results have already been obtained concerning the physical and chemical properties of the sea water in the deep basins which are separated by rather shallow sills. Direct current measurements have been made at two anchor stations (39° and 135°, depth 2300 m. and 1200 m. respectively), where the influence of the tide near the bottom was observed (135°). Moreover, investigations have been carried out at these stations concerning the variations in the properties of the sea water, probably due to internal waves.

Optical Rotatory Power.

THE Faraday Society's second General Discussion on "Optical Rotatory Power" was held in the rooms of the Chemical Society, Burlington House, London, on Friday and Saturday, April 25 and 26. In addition to English workers in this field of research, the Society had the pleasure of welcoming a large delegation of their foreign colleagues, from France, Germany, Italy, Belgium, and Switzerland. The foreign guests included Prof. R. Betti (Bologna), Dr. Bretscher (Zurich), Prof. E. Darmon (Paris), Dr. R. Descamps (Brussels), Dr. Drucker (Leipzig), Prof. P. P. Ewald (Stuttgart), Dr. Werner Kuhn (Heidelberg), Mme. Liquier-Milward (a pupil of Prof. Cotton, now resident in England), Dr. R. Lucas (Paris), and Dr. K. Wolf (Karlsruhe). Papers were also received from Prof. G. Bruhat and Prof. A. Cotton (Paris), and Prof. R. de Malleman (Nancy), who were unable to attend the meetings.

An introductory address by Prof. Ewald on the physical aspects of optical rotatory power was listened to with interest, and will be read with still greater interest when it appears in print. This was followed by a paper on "The Wave-Mechanics of Optical Rotation and of Optically-active Molecules" by Mr. G. Temple, of Trinity College, Cambridge. Up to the present, wave-mechanics has contributed but little to the theory of optical rotatory power, but it appears likely that the challenge provided by this discussion may result at no distant date in the development of a satisfactory method of formulating the older experimental results in terms of the newer theory. At present, some confusion has arisen from attempts to identify the symmetrical and anti-symmetrical forms of the molecule, as they exist in hydrogen and in ammonia, with the dextrorotatory and levorotatory forms of an optically active compound. Since these forms differ in energy content, they must therefore differ (at least slightly) in rotatory power. This conclusion is, however, directly contrary to the well established postulates of Pasteur, and to the doctrine, held universally by all workers during the past hundred years, that enantiomorphism implies an absolute identity of properties, except when these are reversed in sign, but not in magnitude, by reflection in a mirror. This anomaly is one that must be removed as soon as possible, if the newer theories are to prove their equality to or superiority over the old, and Dr. Kuhn (whose simple model of an asymmetric molecule seems likely to provide a bridge between theory and experiment) has already suggested that, instead of being identified with the symmetrical and antisymmetrical solutions of the wave-equations, the dextro and levo forms should each be represented by a combination of these two solutions, with an appropriate difference of phase, so that the precise equality of the mirror image is restored.

The theory of wave-mechanics also postulates that all optical activity is unstable and only of transient duration, but without specifying whether the half-life period is to be reckoned in millions of years or in

millionths of a second. Under these conditions, it is impossible to check the theory against experiments, which have established the apparent permanence of optical activity; but, since racemisation (or the related phenomenon of inversion of one of a series of asymmetric carbon atoms, as in the mutarotation of the sugars) is so often found to depend on a catalyst, many physical chemists would envisage the process as one that occurs normally only in complex molecular systems, although the inversion of pinene vapour has been claimed as an example of an uncatalysed reaction. The racemisation postulated by the theory of wave-mechanics is therefore apparently a phenomenon of a different order from those which have been studied by chemists.

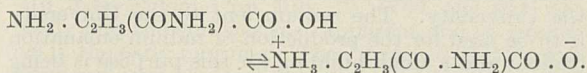
Dr. Werner Kuhn, who contributed a paper on "The Physical Basis of Optical Rotatory Power", has achieved unique success in deriving from theoretical physics results which are sufficiently simple to be of immediate practical value. In particular, whilst Drude's simplified equation for rotatory dispersion is valid only in a region of complete transparency (his complete equation has not yet been tested against experiment), Kuhn's equation is valid right through the region covered by an absorption band. Drude's equation has the merit of having made it possible for the first time to resolve the rotatory power of unsaturated compounds into partial rotations of high and low frequency, which are often of opposite sign; but this analysis is obviously less exact than that of Kuhn, and it is of interest to know that the discrepancy which the writer has observed repeatedly between the characteristic frequencies deduced from direct measurements of absorption and (with the help of Drude's equation) from measurements of rotatory dispersion, can be predicted from Kuhn's equation, in which this discrepancy does not occur.

The three following papers, by Dr. K. Wolf, Dr. H. G. Rule, and Prof. R. Betti, were all concerned with the influence of polarity on rotatory power, a subject on which Dr. Rule has published a long series of papers in recent years. Dr. Wolf in a paper on "The Principle of Free Rotation in Optically Active Molecules" described the measurements which he has made of dipole moments, for example, of the active and meso forms of tartaric acid and its esters, in order to find out whether 'free rotation' occurs about the central bond. He concludes that it does not; but this result can be attributed in some cases to the chemical effect of subsidiary valencies, and further experiments are contemplated on compounds in which this factor is unlikely to be operative. Prof. Betti, who contributed a paper on "Optical Rotatory Power and Chemical Constitution", has prepared a series of derivatives of the base, $\text{HO} \cdot \text{C}_{10}\text{H}_6 \cdot \text{CH}(\text{C}_6\text{H}_5) \cdot \text{NH}_2$, and in order to eliminate the effects of rotatory dispersion, has calculated the 'absolute' molecular rotations of his compounds. He has thus been able to establish a graphical relation,

first between the rotatory power of an alkylidene derivative, $\text{HO} \cdot \text{C}_{10}\text{H}_6 \cdot \text{CPh} \cdot \text{N}=\text{CHX}$, and the dissociation constant of the corresponding acid $\text{X} \cdot \text{COOH}$, and *secondly* between the rotatory power of the compound and its dipole moment. One of his curves leads to the remarkable conclusion that, if the dipole moment were reduced to zero, the rotatory power of the compound would also disappear or become very small.

In the section of the discussion dealing with apparatus and methods, only the paper of Dr. Descamps on "Ultra-violet Polarimetry" was communicated to the meeting.

The papers of Prof. Darmais and of Mme. Milward dealt with the effects of neutral salts on the rotatory power of (1) tartrates and tartaric esters, (2) asparagine. The tartaric esters always show a depression of rotatory power, but in the case of the salts an exaltation is sometimes observed. These effects are attributed to the deformation of the tartaric radical, and to variations in the hydration of the tartaric ion. In the case of asparagine, it was suggested that neutral salts act by turning the molecule into a *zwitterion*.



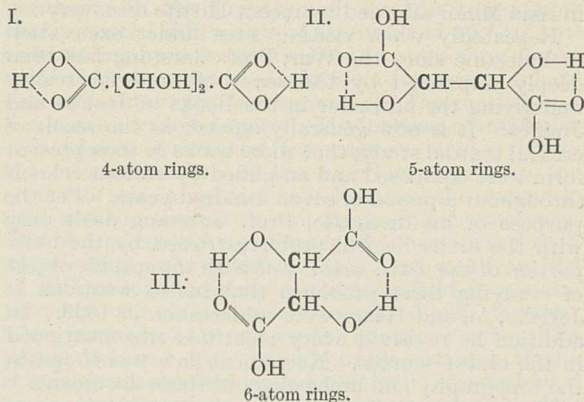
This effect was interpreted as depending on the polarisation of the molecule under the influence of ions bearing charges of opposite sign.

Issues of a more controversial character were raised in the discussion of the origin of the variations of optical rotatory power in solution. Measurements of rotatory dispersion have proved that the anomalous rotatory dispersion of ethyl tartrate can be expressed as the sum of *two* simple partial rotations of opposite sign; but, in order to explain the effects of temperature, Dr. Lucas has had to assume the presence of *three* modifications of the ester. He has also postulated that these may depend on the existence of three maxima of stability in the 'free rotation' of one-half of the molecule relative to the other. It was unfortunate that, in the absence of Prof. G. Bruhat and of Prof. T. S. Patterson, the opposite view (which regards all the anomalies of tartaric acid as normal attributes of the molecule, $\text{HO} \cdot \text{CO} \cdot \text{CHOH} \cdot \text{CO} \cdot \text{OH}$) was defended only in writing. Dr. R. Lucas had no difficulty in showing that the variations of rotatory power with concentration and temperature are not, as Bruhat suggests, theoretically incompatible with a dynamic equilibrium between various isomeric forms of the acid, since this deduction is only valid if the solvent is regarded (as in the early history of the theory of electrolytic dissociation) as equivalent to empty space. It has also been established, by experiments on compounds such as ethyl acetoacetate and benzoylcamphor, that the equilibrium concentrations of dynamic isomerides are displaced by changes of solvent, perhaps in response to variations in the relative solubility of the various forms.

In defence of Arndtsen's theory, that the anomalous behaviour of tartaric acid is due to the presence of more than one form of the acid, Dr. P. C. Austin urged that the real problem is not so much to explain the existence of the anomalies, as to account for their complete disappearance in certain derivatives of tartaric acid which contain the complete electronic system of the acid, but with the addition of certain radicals, as in methylene tartaric acid or borotartaric acid. Until some attempt is made to explain these well-established facts in terms of the normal structure of tartaric acid, it can be claimed that Arndtsen's hypothesis (even although it remains only a hypothesis)

is the only one that covers the experimental data which are now available.

Some discussion arose as to whether the impedance of free rotation by the development of positions of maximum stability, as suggested by Lucas, would be sufficient to account for the variations of rotatory power of the different forms, and, in particular, for the reversal of sign that is required to explain the anomalous rotatory dispersion of tartaric acid and its esters. According to van 't Hoff's theory of optical superposition, no change of rotatory power would be produced by free rotation about the central bond; but it was generally agreed that some modification of rotatory power might be produced by a mutual induction between the polar groups in the two halves of the molecule. The writer expressed the opinion that, in view of the known tendency for carbonylic oxygen and hydroxylic hydrogen to interact (as pointed out by Pfeiffer in 1913 in the case of *o*-hydroxy-antraquinone), it was unlikely that tartaric acid would be an exception to this rule. It is therefore almost inevitable that isomeric forms of the acid should be produced, according as the carbonyl radical interacts with the hydroxyl group of its own acid radical, or with one or other of the alcoholic hydroxyl groups, which are attached directly to the asymmetric carbon atoms, giving rise to systems containing rings of 4, 5, or 6 atoms, as follows:



The proportions in which these would be present would depend on the relative stability of the various rings; and their rotatory powers would be likely to show greater contrasts than any that could be produced by the impedance of free rotation of the two halves of the molecule in formulæ I. and II.

The remaining part of the discussion, dealing with the chemical aspects of optical rotatory power, was largely non-controversial in character. Dr. W. H. Mills gave an admirable account of the conditions under which molecular dissymmetry of the most varied type can give rise to optical activity. His own study of impedance of free rotation by steric hindrance in the naphthalene series, following on Kenner's discovery of optical activity arising from a similar impedance in the diphenyl series, is of special interest as a case in which thermal agitation alone might suffice to produce a momentary removal of the constraint and so give rise to racemisation without the aid of a chemically-active catalyst. Dr. J. Kenyon then contributed two papers, on "Relations between the Rotatory Powers of the Members of Homologous Series"; and, with Dr. H. Phillips, on "Some Recent Developments in the Study of the Walden Inversion", which also did not lead to any keen discussion, since they were mainly a record of well-established facts.

After the meetings in London, almost all the foreign guests made the journey to Cambridge, where a

reception was given in the Laboratory of Physical Chemistry, at which Prof. and Mrs. Wiegner of Zurich were also present. In addition to exhibits of polarimetry, refractometry, ultra-violet and infrared spectroscopy, photochemistry, electron bombardment, molecular rays, and a number of exhibits in branches of physical chemistry less directly related to optical rotatory power, the adjoining Magnetic Laboratory was thrown open to inspection by permission of Sir Ernest Rutherford, and Dr. P. Kapitza was able to show the production of liquid and solid hydrogen, which has been suspended in Great Britain since the death of Sir James Dewar. T. M. LOWRY.

Archæology and Bible History.

PROF. JOHN GARSTANG'S Friday evening discourse on "The Historicity of the Books of Joshua and Judges" delivered at the Royal Institution on May 9, apart from the intrinsic interest of any topic relating to the archæology of the Bible, was notable as affording some further examples of the way in which recent archæological investigation has served to confirm tradition. The discovery of evidence in Mesopotamia tending to substantiate the authenticity of the story of the Flood in the Bible and in Sumerian legend is a case in point; and Prof. Garstang himself referred to the confirmation of the Homeric account of Achæan activities in Asia Minor afforded by recent Hittite discovery.

Repeatedly when visiting sites under excavation in Palestine since the War, Prof. Garstang has been deeply impressed by the sense of material reality underlying the narrative in the Books of Joshua and Judges. It is now generally agreed, as the result of critical textual study, that these books in their present form were composed and amplified by various schools throughout a period of seven hundred years. For the purpose of his discourse, Prof. Garstang dealt only with the archæological problems raised by the older portion of the text; and it was with the specific object of studying these problems that his excavations at Jericho, Ai, and Hazor were undertaken in 1928. In addition he revisited every identified site mentioned in the oldest sources. No radical flaw was found in the topography and archæology of these documents.

The results of Prof. Garstang's investigations as summarised in his discourse are of profound interest and of singular significance in their bearing upon the historicity of these Bible narratives. All the identified sites mentioned in Joshua and Judges i. to v., such as Gezer, Megiddo, Bethshean, and Hazor, flourished in the Bronze Age, and for the most part were positions of strategic importance. The names of no less than twenty-four cities of the Canaanites in the age of Joshua are identical with those mentioned in the annals of Pharaohs of the xviiith Dynasty, especially from Tothmes III. to Akhenaten, that is from 1475 to 1375 B.C. Among the cities which the Israelites could not capture were Bethshean, Megiddo, Acco, Gezer, Jerusalem, and Gaza. These are found to be organised centres of Egyptian authority. It thus becomes clear that the background of the exploits of Joshua was that disclosed by the Egyptian records of the fifteenth century B.C.

Prof. Garstang's excavations at Jericho, Ai, and Hazor in 1928, and further investigations at Jericho early in the present year, fully bear out this interpretation. It has been found that each site shows traces of destruction near the middle of the late Bronze Age or about 1400 B.C. Ai and Hazor were abandoned as from that time, and Jericho was not rebuilt for centuries. At Bethel and Debir layers of destruction have been disclosed which are to be dated at the end of the fifteenth century. Bringing these results into relation with the tradition that the Exodus

took place 480 years before the building of Solomon's temple, that is, about 1447 B.C., the date of Joshua's invasion of Canaan would fall about 1407 B.C. This tradition has been mistrusted; but if the later additions to the Book of Judges are disregarded, the discrepancies disappear.

Thus, Prof. Garstang concludes, all available archæological and literary evidences point to the same date in the middle of the late Bronze Age, and the historical and topographical allusions in the Books of Joshua are found to be in accord with the material results of investigation. Further, Israel's position under the Judges falls into the frame afforded by Egyptian chronology and the record of Egyptian relations with Canaan. The records of both books were founded on fact.

University and Educational Intelligence.

BIRMINGHAM.—The University having been associated with the Birmingham General Hospital as constituting the Birmingham centre of the Radium Commission, 1 gm. of radium has been lent by the Commission to the General Hospital and 0.5 gm. to the University. The radium lent to the University is to be used for the production of radium emanation (radon) and a small building for this purpose is being erected as part of the Physics Department under the control of the Poynting professor of physics, Prof. S. W. J. Smith. The radon produced is to be distributed to all hospitals which are at the present time recognised by the Faculty of Medicine as teaching institutions connected with the University. Certain other institutions in the area, on making application to the Faculty and furnishing evidence of suitability, will also be supplied.

CAMBRIDGE.—Dr. W. E. Dixon, of Downing College, has been reappointed reader in pharmacology.

MANCHESTER.—A bronze plaque of the late Prof. W. H. Perkin, presented by former students and friends, will be unveiled in the Chemistry Theatre of the University on Saturday, May 24, at 11 A.M., and friends of the late Prof. Perkin are invited to be present.

The Council has accepted the offer of Mr. James Grier and Mr. Harry Brindle to institute two silver medals in pharmaceuticals. The medals will be offered annually for competition to the students of the chemist and druggist course and of the pharmaceutical chemist and B.Sc. in pharmaceuticals courses.

OXFORD.—The sixth annual report of the Lewis Evans Collection was presented to Convocation on May 6 by the curator, Dr. R. T. Gunther, of Magdalen College. It contains an account of the restoration work on the Old Ashmolean Building which has been carried out by the University Chest, and records the installation of the new armorial windows on the main staircase. A long list of accessions to the Collection is included, and the report goes on to point out that if the original "Officina Chémica" in the basement, at present used for the storage of books, could be made available, it would be possible to refit "the most historic laboratory in Britain with its own apparatus", much of which was used there by Charles Daubeny a hundred years ago. The report ends with a record of the lectures and research work undertaken and the publications issued during the past year, together with a note as to the financial needs of the Collection.

On the motion of Dr. F. W. Pember, Warden of All Souls' Congregation has passed a decree authorising a grant of £50 towards the expenses of an expedition organised by a body of undergraduates who propose to make during the present year an ecological survey of Lapland and western Norway.

Historic Natural Events.

May 18, 1680. Hailstorm in London.—According to Dr. Hooke, about 10.30 the sky grew very dark and there was thunder, very near. Soon after there began to fall “a good quantity of hailstones, some of the bigness of pistol-bullets, others as big as pullets’ eggs, and some above $2\frac{1}{2}$ inches, and near 3 inches over the broad way; the smaller were pretty round, and white, like chalk or sugar plums; the others of other shapes”.

May 18–19, 1888. Thunderstorms.—On the night of May 18–19, a thunderstorm passed across England and southern Scotland from south to north at the rate of 50 miles per hour. On May 19 there was a series of isolated thunderstorms. In Glasgow the storm was described as “the most awful occurrence of the kind which has been recorded in the annals of the Observatory”. It was accompanied by torrential rain and hailstones as large as pigeon’s eggs. Much damage was done by lightning in several parts of the country, and people were killed at no fewer than ten different places in southern Scotland and northern England.

May 19, 1780. ‘Black Friday’ or ‘The Dark Day’.—In New England on May 19, 1780, the sky was cloudy and the sun was just apparent and of reddish hue in the early morning. Then it rained slightly and thundered, and the darkness grew, so that large print could not be read, nor could business be transacted. Schools were dismissed, and all work ceased. Fowls went to roost as at night, frogs began to pipe, night birds sang and cocks crew. The darkness began to clear at 1.30 P.M. and by 3.15 P.M. the light was as usual for a thick cloudy day.

May 19, 1809. Hailstorm in London.—A violent thunderstorm began about 5 P.M. accompanied by hailstones an inch in diameter. Carried by a strong south wind, they destroyed a great number of skylights and south windows, and collected in great drifts. The stones travelled with such speed that they left clean round holes in the glass, like bullet holes.

May 19, 1811. Whirlwind near Sheffield.—A whirlwind, accompanied by hailstones up to five inches in circumference, tore up seven trees by the roots, broke others in the middle, and unroofed many buildings. Nearly all the water was carried out of a mill-dam and dispersed in the air.

May 21, 1846. The Beginning of the Notably Hot Summer.—This date was the beginning of the ‘Notably Hot Summer’ and severe drought which continued until Sept. 23. From the effects of this amazing summer, many horses and some men died; and many kinds of provision were much spoiled, whether bread, meat, cheese, butter, ale or wine; and many other articles were greatly injured. The corn harvest was very early, and the wheat crop good. This was, for continuance, the hottest summer since 1780, if not since 1750; but 1818 and 1826 were rather similar.

May 21, 1890. Refraction Phenomena.—The rising sun at Brunn in Bohemia was observed to take a series of remarkable shapes before it finally rose well above the horizon and became circular. The earliest form was a conical tower with a flat cap, changing through cylindrical to urn-shaped. The next stage showed the form of a mushroom complete with a short stem, and finally the stem became detached and gradually disappeared. The whole series of changes occupied eight minutes.

May 24, 1681. Drought.—Under this date Evelyn records: “There had scarce fallen any rain since Christmas.” On June 11 he adds, “It still continued so great a drought as had never been known in England. In the Rector’s Book of Clayworth, Notts, June 18: “Barley found dry in ye fields, having lain so, ever

since sowing time”, and in his summary of the year: “It was a very dry and drought year fro ye beging of April [the Rector’s year began on April 1, old style] to ye 20th June, not having raynd, except on ye 7th of May.” At Townley in Lancashire the rainfall this year was only 76 per cent of the average.

May 24, 1783. Dust Haze.—From May 24 until almost the middle of August, there was an unusually dense and very persistent high fog over the whole of Europe, Asia Minor, Syria, Iceland, and many other countries. This was probably due to volcanic dust from the eruption of Laki, Iceland. The weather was greatly disturbed; in Europe there was a persistent southerly wind and great heat, and the Nile flood was abnormally low. The following winter, 1783–84, was very long and very rigorous over the whole of Europe and in North America. Gilbert White records hard frost so late as April 2.

Societies and Academies.

LONDON.

Physical Society, May 9.—E. J. Williams: (1) The induction of electromotive forces in a moving liquid by a magnetic field, and their application to the investigation of the flow of liquids. Preliminary experiments on the flow through straight tubes show that potential differences of the order of 10^{-4} to 10^{-3} volt set up by a magnetic field in a moving liquid consisting of an aqueous solution of copper sulphate can be satisfactorily measured.—(2) The motion of a liquid in an enclosed space. The increase of resistance of a column of mercury in a magnetic field is due to the internal motion of the liquid produced by the action of the ampere forces between the magnetic field and the electric current traversing the mercury. The hydrodynamic significance of the results of such experiments is considered; e.m.f.’s as small as 10^{-6} to 10^{-7} volt, induced by a magnetic field in moving mercury, can be accurately measured.—E. Simeon: The generation of sound by the siren principle. The paper discusses various undesirable features of the simple siren considered as a sound-source for technical work, and describes a siren with a reasonably pure note, the intensity of which can be kept constant throughout a range of pitch from about 70 to about 7500 cycles.—L. Hartshorn: Surface resistivity measurements of solid dielectrics. The paper describes (1) a new form of electrode suitable for surface resistivity measurements on insulating materials in sheet form, and (2) a method for the determination of the ‘volume leakage’ correction for any system of electrodes. Data are given on the volume leakage correction for the various types of electrode in general use, and on the ‘leakage resistivities’ of materials commonly used in the construction of laboratory instruments.

PARIS.

Academy of Sciences, Mar. 31.—Mesnager: Must the solution of the problem of the cylinder given by Saint-Venant sometimes be rejected? A criticism of a recent communication by Henri Villat and Maurice Roy. Without questioning the mathematical work, the author is not in agreement with the practical interpretations deduced.—Marcel Brillouin: Dynamical tides with continents. The law of depth and the attraction of the ring.—C. de La Vallée Poussin: The conformal representation of plane areas multiply connex.—Paul Pascal and René Leclair: The chemical and magnetic study of complexes derived from the triazine nucleus.—A. Tonolo: A physical interpretation of the tensor of Riemann and of the principal curvatures of a

variety V_3 .—Mohamed A. Haque: The magnetic double refraction of ethyl alcohol, of water and of aqueous solutions of nitrates.—F. Baldet: Observations, with the large Meudon telescope, of the celestial body discovered at the Lowell Observatory. A trans-Neptunian planet, with the distance and diameter given by the discoverers, should shew a planetary disc of about $1.0''$, of the same order of magnitude as the satellites of Jupiter, and this should be easily visible with the large telescope of the Meudon Observatory (83 cm. objective), which has a separating power of $0.17''$. Observations on four days, one under exceptionally good conditions, failed to shew any trace of a disc.—E. Henriot and Mlle. A. Marcelle: The direct measurement of the ratio of the absolute retardations in double refraction by deformation.—B. Bogitch: The preparation of blue glass and the decomposition of sodium sulphate by silica.—M. Prettre and P. Laffitte: The inflammation and combustion of carbon disulphide. For percentages of carbon disulphide vapour varying between 1.3 and 34.0 by volume, the temperatures of inflammation vary linearly between 138°C . and 338°C . For mixtures containing more than 10 per cent of carbon disulphide, luminescence of the gaseous mixture is observed before inflammation, but this is always less intense than that observed in the case of carbon monoxide. In all the experiments there was noticed a slight brown deposit on the walls of the apparatus: this was shewn to be the monosulphide, CS or a polymer.—Marcel Godchot and Max Mousseiron: New methods of formation of 2:5-dimethyl-piperazine. Three new methods are given, the first two starting with 2.5-dimethylpyrazine: catalytic reduction with hydrogen in presence of nickel at 150° - 160°C ., reduction with hydrogen in acetic acid solution with platinum as the catalyst: the third method, the simplest, is the reduction by hydrogen in presence of platinum in acetic acid solution of isonitrosoacetone.—F. François: The action of selenoxanthidrol on ureas and carbamic esters. The typical reaction between xanthidrol and ureas and carbamic esters occurs when the oxygen of the pyrane nucleus is replaced by sulphur or by selenium.—Paul Gaubert: The dehydration of heulandite.—Henri Vincienne: Stratigraphical and tectonic observations on the southern termination of the Crédo chain.—Henri Mémery: The winter of 1930 and solar activity.—H. Buisson, G. Jausseran, and P. Rouard: The transparency of the lower atmosphere. The results of direct measurements of atmospheric absorption over distances of 600 metres and 2500 metres for wave-lengths varying from 5780 to 2482. It is hoped to extend the results to smaller wave-lengths.—Link and Hugon: Direct measurements of atmospheric absorption.—V. N. Lubimenko and Mme. Rauser-Černooussova: The fossil remains of chlorophyll in marine mud deposits. Observations published in 1921 suggested that the pigment of chlorophyll, in the absence of oxygen, possesses great stability and might be preserved as a fossil substance. Results are given in the present paper confirming this view. Four specimens, of varying age, one belonging to the Tertiary age, gave alcoholic extracts containing chlorophyll, as shown by spectroscopic examination.—Jakob Eriksson: The hibernation of *Puccinia Ribis* is the vegetative state in the winter buds of the plant acting as host.—J. des Cilleuls: The phytoplankton of the Loire in the course of the summers of 1928 and 1929. Owing to the exceptional warmth and dryness of the summers of 1928 and 1929 the plankton of the Loire was unusually abundant, recalling a lake regime. Analogous observations were made on the plankton of the Elbe, near Dresden, and also near Hamburg, during the dry summer of 1904.—Pierre Dangeard: The

mobility of certain cells of *Porphyridium cruentum*.—Raymond-Hamet: The physiological analysis of the intestinal action of Uzara.—Georges Truffaut and V. Vladykov: The microflora of the rhizosphere of wheat.—J. Vellard: Antivenomous vaccination. Results of experiments on the production of vaccines exerting a protective action against the bites of poisonous snakes.—J. André Thomas: A neoplastic reaction due to the degeneration of the ovocytes and sometimes of the bristles in *Nereis diversicolor*. The formation of conjunctive tissue from the newly-formed amibocytes.

ROME.

Royal National Academy of the Lincei, Jan. 19.—T. Levi-Civita: Characteristics and bicharacteristics of Einstein's gravitational equations (2).—U. Cisotti: Dynamic actions of circulatory currents around a bilateral strip or an arched strip. The considerations advanced in an earlier note are illustrated by two concrete examples.—V. Nobile: Intermediary trihedra of reference for stellar dynamics; criteria of choice.—L. Cambi and A. Cagnasso: The reactions between ferrous compounds and nitric oxide (2). Nitric oxide undergoes association with ferrous salts having anions of slight electro-affinity and of a high degree of oxidisability (such as the carbonate, hydrogen carbonate, and acetate), giving first nitroso-salts with groupings (NO') having a halogen-like function unlike that of hyponitrous acid, into which such groupings undergo subsequent transformation. This transformation is effected by decomposition with silver salts in a neutral or feebly acid medium, or by a sufficient increase of the pH value, such as is caused by addition of excess of the alkali salt of the same acid as is present in the ferrous salt used.—R. G. Harrison and P. Pasquini: Grafting experiments with *Clavelina lepadiformis* (Müller).—L. Petri: Experimental reproduction of *mal del secco* of lemons. This disease, which causes serious damage to lemon plantations on the eastern coast of Sicily, is the result of attack by two distinct fungi. The wood is first attacked by *Deuterophoma*, which causes tracheomycosis or adromycosis, which is shown externally only by partial or total yellowing of the leaves and cortical tissue. This primary phase of the disease renders possible subsequent antracnosis of the buds and young branches, the cause in this case being infection with *Colletotrichum gloeosporioides* Penz. The disease may be produced by artificial inoculation with the two organisms.—Rina Baldoni: Systems of principal normals to a variety at its π_3 (1).—S. Cherubino: A general theorem on real Abelian varieties.—N. Cioranescu: Approximation of a function by another function belonging to a given linear functional, and approximation of any vectorial field by an irrotational field.—H. Lewy: The unicuity of the solution of Cauchy's problem for an elliptical equation of the second order in two variables.—A. Lusi: Investigation of the permutable functions of the first species with a given function.—Maria Cibrario: The non-existence of congruences W of certain hyperspatial straight lines.—R. L. Gomes: Isoenergetic movements.—B. Finzi: Dynamic actions relative to plane irrotational currents of viscous liquids. The analytical formulæ recently deduced are applied to the determination of the dynamic actions exerted on a rigid profile enclosed by a regular current.—G. Viola: Fluctuations of the light curve of U. Cephei. The various hypotheses capable of explaining this phenomenon are discussed.—G. Scagliarini and P. Pratesi: Potentiometric determination of alkaline sulphides. The interaction of sodium nitroprusside and an alkaline sulphide results in the formation of a complex salt comprising one molecule of each of the reagents. Investigation of the curve of electrometric titration of

decinormal solutions of the two compounds reveals a well-marked point of flexion corresponding with equivalence of the solutions. This result furnishes the basis for a method of determining sulphides, even in the presence of large proportions of other salts.—Z. Jolles and J. Krugliakoff: Investigations on diazohydrates, azoxy-compounds, and nitrones. It was recently found that normal diazohydrates exhibit all the properties characteristic of an energetic oxidising agent. Further experiments show that the same is the case with the analogous compounds, α - and β -azoxy-compounds, nitrosophenylhydroxylamine, and nitrones.—M. Anelli: A geological section of the Reggian Apennines.—G. B. Cacciamali: Problems of Lombardy tectonics (with reference to investigations on the sub-soil).—S. Di Franco: The lava from the eruption of Etna in 1928. Study of the different lavas of Mount Etna shows that these may be grouped into seven types. The lava from the eruption of 1928 is dark grey, tending to reddish, and moderately heavy, and is analogous microscopically to those of the later eruptions and also to some of the older ones. It contains pheno-crystals of plagioclase, augite, and olivine, disseminated in a basic mass composed of plagioclase, augite, magnetite in abundance, and vitreous substance in small proportion. It belongs to type III. of the author's classification.—G. Mezzadroli and E. Vareton: Further investigations on the action exerted by a radio-oscillator for ultra-short waves (2-3 metres wavelength) on the germination of seeds and on the growth of plants (2). Experiments on cotton, beans, peas, and maize show that when seeds and plants are subjected to the action of these waves, the germinators being placed between the coils of the receiving oscillating circuit, the effect is even greater than that observed with an interposed Lakhovsky oscillating circuit or with systems of Lecher wires in the zone of greatest intensity.

VIENNA.

Academy of Sciences, Feb. 20.—R. Schumann: The vectorial adjustment of triangle-nets.—A. Skrabal: The development of chemical mechanics. Our kinetic equations of 'relation' are valid as limiting laws for constant media, that is, for dilute systems. They can be generalised and carried over to systems however variable if for relations we substitute 'activities'.—G. T. Whyburn: (1) Possibly regular point-quantities.—(2) The structure of regular curves.—(3) Irreducible ϵ -partition quantities.—G. Lock: Cannizzaro's reaction.—M. Beier: Zoological expedition to the Ionian Islands. (8) Coleoptera, with the help of A. Schuster, R. Hicker, and H. Strouhal.—(9) Spiders, with the help of E. Reimoser and C. F. Roewer.

Feb. 27.—K. Fuchs and P. Gross: The action of alkali-organic compounds on aromatic sulphonates. The experiments were carried out in a nitrogen atmosphere.—P. Gross and A. Goldstern: Optical determination of electrolytic dissociation in very dilute alcoholic solution. Coefficients of extinction were measured in solutions of lithium picrate alone and with addition of lithium chloride, and in picric acid alone and with addition of lithium chloride.—F. Heritsch: A coral from the Grauwacke zone of the Veitsch in Upper Styria.—A. Dadiou and K. W. F. Kohlrusch: Studies on the Raman effect (7). The Raman spectrum of organic substances.

Mar. 6.—B. Machan: Two new fish forms from Padang.—M. Beier: Zoological expedition to the Ionian Islands (10). The shell-bearing land and fresh-water molluscs, worked out by F. Käufel.—P. Gross and M. Iser: Salting out. The distribution of acetone and of prussic acid between benzol and the aqueous solutions of various salts.—T. Pintner: Further contributions to the anatomy and systematics

of *Tetrarhynchus*.—K. Menger: A distance concept in groups.—G. Nöbeling: N -dimensional universal spaces.

Mar. 13.—P. Gross and S. Klinghoffer: The influence of alkali chlorides on the solubility of calcium iodate.—O. Schindler: A new *Hemirhampus* from the Pacific Ocean.—E. Späth and K. Gibian: The constitution of sappanin.—E. Späth and J. Piki: New bases in angostura bark: quinoline, 2-methylquinoline, 2-n-amyloquinoline and 1-methyl-2-kefo-1, 2-dihydroquinoline.—K. Prziham: (1) The coloration of kunzite.—(2) The influence of cathode rays on the swelling of gelatin.

Official Publications Received.

BRITISH.

Transactions of the Optical Society. Vol. 31, No. 1, 1929-30. Pp. iv+52. (London.) 10s.

The Scientific Proceedings of the Royal Dublin Society. Vol. 19, N.S., Nos. 29-39. 29: Studies on Peat, Part 3, Low Temperature Carbonization of Peat, by James T. Donnelly and Joseph Reilly; 30: The Nitration of Substituted Phenylbenzylamine Derivatives, by J. Reilly, T. V. Creedon and P. J. Drumm; 31: A Study of Two new Species of Bacteria belonging to the Genus *Chromoactetium*, by Dr. M. Grimes; 32: The Thermal Instability of the Earth's Crust, II., Dr. J. H. J. Poole; 33: Study of the Polysaccharides, Part 1, Inulin and Inulan, by J. Reilly and P. P. Donovan; 34: Responses of Plant Tissues to Electric Currents, II., by Prof. H. H. Dixon and T. A. Bennet-Clark; 35: Electrical Properties of Oil-Water Emulsions with special reference to the Structure of the Plasmatic Membrane, by Prof. Henry H. Dixon and T. A. Bennet-Clark; 36: Studies in Peat, Part 4, Low Temperature Carbonization under various Conditions, by Colm O'Sullivan and Dr. Joseph Reilly; 37: The Application of Gamma Radiation to Deep-seated Tumours, by Dr. J. J. Joly; 38: A Study of the Polysaccharides, Part 2, Note on the Purification of the Natural Products, by J. Reilly and Declan T. McSweeney; 39: Some Geochemical Applications of Measurements of Hydrogen Ion Concentration, by Dr. W. R. G. Atkins. Pp. 365-460. (Dublin: Hodges, Figgis and Co.; London: Williams and Norgate, Ltd.) 6s.

Harper Adams Agricultural College, Newport, Shropshire. Grassland Problems: the Making of Grassland, the Maintenance of Grassland, the Utilisation of Grassland; Report of Conference held at the College on Wednesday, February 5th, 1930. Pp. 15+ix. Sugar Beet Problems: Report of Third Conference held at the College on Thursday, March 13th, 1930. Pp. 28. (Newport.)

Transactions of the Institute of Marine Engineers, Incorporated. Session 1930, Vol. 41. April. Pp. 983-990+lxvii+xxxviii. (London.)

Papers and Proceedings of the Royal Society of Tasmania for the Year 1929. Pp. v+151+31 plates. (Hobart.) 10s.

FOREIGN.

Det Norske Videnskaps-Akademi i Oslo. Resultater av de Norske Statsunderstøttede Spitsbergenekspeditioner (Skrifter om Svalbard og Ishavet). Bind 1, Nr. 1: The Norwegian Svalbard Expeditions 1906-1926. By Adolf Hoel. Pp. 104+2 plates. (Oslo: Jacob Dybwad.) 10.00 kr.

Annuaire de l'Académie Royale des Sciences, des Lettres et des Beaux-Arts de Belgique, 1930. 96^e année. Pp. 155. (Bruxelles: Maurice Lambert.)

Agricultural Experiment Station: Michigan State College of Agriculture and Applied Science. Circular Bulletin No. 130: Cultural Methods in the Bearing Vineyard. By N. L. Partridge. Pp. 19. Circular Bulletin No. 131: The Cherry Fruit-Flies. By R. H. Pettit and G. S. Tolles. Pp. 11. Special Bulletin No. 195: Maintaining the Productivity of Cherry Trees. By V. R. Gardner. Pp. 27. Technical Bulletin No. 102: Keeping Qualities of Butter. vi. Experiments on the Production of Metallic Flavor in Butter and Milk; vii. The Microbic Flora of Off-flavored Butter. By G. L. A. Ruehle. Pp. 46. Technical Bulletin No. 103: The Pathogenicity of the Species of the Genus *Brucella* for the Fowl. By I. Forrest Huddleson and M. W. Emmel. Pp. 30. (East Lansing, Mich.)

Biblioteca Nacional. Exposição de Física, Abril de 1930. Catalogo. Pp. 96. (Lisboa.)

U.S. Department of Agriculture. Farmers' Bulletin No. 1624: The Mexican Bean Beetle in the East and its Control. By Neale F. Howard. Pp. ii+14. (Washington, D.C.: Government Printing Office.) 5 cents.

Proceedings of the Academy of Natural Sciences of Philadelphia, Vol. 82. A new Woodpecker from Angola: Fourth Preliminary Paper on the Birds collected during the Gray African Expedition, 1929. By W. Wedgwood Bowen. Pp. 89-90. (Philadelphia.)

University of Illinois Engineering Experiment Station. Bulletin No. 204: The Hydroxylation of Double Bonds. By Sherlock Swann, Jr. Pp. 14. 10 cents. Bulletin No. 205: A Study of the Ikeda Short-Time (Electrical Resistance) Test for Fatigue Strength of Metals. By Herbert F. Moore and Seichi Konzo. Pp. 31. 20 cents. Bulletin No. 206: Studies in the Electrodeposition of Metals. By Prof. Donald B. Keyes and Sherlock Swann, Jr. Pp. 18. 10 cents. (Urbana, Ill.)

Mitteilungen der Naturforschenden Gesellschaft Bern aus dem Jahre 1929. Pp. xi+136+18 Tafeln. (Bern: Paul Haupt.)

Achema Jahrbuch, Jahrgang 1928-30: Berichte über Stand und Entwicklung des chemischen Apparatewesens. Herausgegeben von Dr. Max Buchner. Pp. 260+64+xi. (Seele bei Hannover und Berlin: Dechema, Deutsche Gesellschaft für chemisches Apparatewesen E.-V.) 10 gold marks.

Acta Phytochimica. Edited by Prof. Keita Shibata. Vol. 5, No. 1, April. Pp. 97. (Tokyo: The Iwata Institute of Plant Biochemistry.)

Memoirs of the College of Science, Kyoto Imperial University. Series A, Vol. 13, No. 2, March. Pp. 101-173+11 plates. (Tokyo and Kyoto: Maruzen Co., Ltd.) 1.50 yen.

The Science Reports of the Tôhoku Imperial University, Sendai, Japan. First Series (Mathematics, Physics, Chemistry), Vol. 19, No. 1, March. Pp. 153+7 plates. (Tokyo and Sendai: Maruzen Co., Ltd.)

Field Museum of Natural History. Botany Leaflet 14: Indian Corn. By James B. MacNair. Pp. 34. 25 cents. Anthropology Leaflet 29: Tobacco and its Use in Africa. By Berthold Laufer, Wilfrid D. Hamby and Ralph Linton. Pp. 45+6 plates. 25 cents. (Chicago.)

CATALOGUES.

Library Sets of Standard Works: English Literature, History, Translations, etc. (Catalogue 524.) Pp. 15. (London: Francis Edwards, Ltd.)

A Selection of Rare Books. (Catalogue No. 29.) Pp. 73. (Newcastle-on-Tyne: William H. Robinson.)

Bisoxyl in the Treatment of Syphilis. Pp. 8. (London: The British Drug Houses, Ltd.)

Catalogue of Books on the subjects of Botany and Horticulture. (No. 176.) Pp. 34. (London: Dulau and Co., Ltd.)

Diary of Societies.

FRIDAY, MAY 16.

ROYAL SOCIETY, EDINBURGH, at 4.30.—Prof. G. Wiegner: Base Exchange (Address).

BRITISH INSTITUTE OF RADIOLOGY (Medical Meeting), at 5.—Radiology in Urinary Diseases and General.

ROYAL COLLEGE OF SURGEONS OF ENGLAND, at 5.—Sir Arthur Keith: The Anatomy of Fossil Man: The More Recent Discoveries of Neanderthal Man in Europe. The Present Position of the Neanderthal Problem.

ROYAL SOCIETY OF MEDICINE (Electro-Therapeutics Section) (Annual General Meeting), at 7.

ROYAL PHOTOGRAPHIC SOCIETY OF GREAT BRITAIN (Pictorial Group—Informal Meeting), at 7.

INSTITUTE OF CHEMISTRY (Belfast and District Section) (at Royal Belfast Academical Institution), at 7.30.—Annual General Meeting.

INSTITUTION OF ELECTRICAL ENGINEERS (Scottish Centre) (at Dundee Technical College), at 7.30.—R. H. Fowler: Some Recent Advances in the Electron Theory of Metals (Kelvin Lecture).

ROYAL SOCIETY OF MEDICINE (Obstetrics and Gynaecology Section) (Annual General Meeting), at 8.—Dr. F. J. Hector: A Case of Endometrioma.—Dr. G. W. Theobald: The Toxemias of Pregnancy; a New Conception.—A. J. Wrigley: Puerperal Infection by the Pathogenic Anaerobic Bacteria.

ROYAL INSTITUTION OF GREAT BRITAIN, at 9.—Dr. C. M. Yonge: The Great Barrier Reef of Australia.

ASSOCIATION OF ECONOMIC BIOLOGISTS (at Forest Products Research Laboratory, Princes Risborough).

SATURDAY, MAY 17.

BIOCHEMICAL SOCIETY (in Department of Physiology, School of Medicine, Leeds), at 3.—C. Rimington: (a) Some Observations upon the Colorimetric Determination of Cystine by Means of the Uric Acid Reagent; (b) The Carbohydrate Complex present in the Blood-serum Proteins.—J. B. Speakman: The Denaturation of Wool.—W. T. Astbury: The Inner Structure of Hair as Revealed by X-ray Analysis.—F. C. Thompson and L. Goldman: The Dissociation Constants of Chebulinic Acid.—F. C. Hapgood: The Oxidation of Phenols by Bacterial Suspensions.—C. E. M. Pugh: The Mode of Action of Tyrosinase.—A. Wormald and L. R. Johnson: The Action of Sodium Hydroxide on Serum Proteins in Relation to Antigenic Activities.—K. Turner: The Fatty Acids from the Liver of the Sheep.—M. Thomas: HCN-zymosis and H₂S-zymosis.—H. J. Channon and G. A. Collinson: The Ether-soluble Phosphorus of Blood.—J. Gordon and P. G. Marshall: The Distribution of Phosphorus in Bacterial Cultures.—Demonstrations.—W. T. Astbury: X-ray Photograph of Hair Structure.—A. T. King: The Variability in the Sulphur Content of Wool.—G. L. Brown and B. A. McSwiney: Collection of Secretion from Pyloric Antrum of the Dog.

PHILOLOGICAL SOCIETY (jointly with Oxford Philological Society) (at Magdalen College, Oxford), at 5.30.—Dr. B. F. C. Atkinson: Ancient Illyrian.

MONDAY, MAY 19.

ROYAL GEOGRAPHICAL SOCIETY (at Æolian Hall), at 8.30.—Lt.-Col. R. C. F. Schomberg: Journeys in the Tien Shan.

TUESDAY, MAY 20.

ROYAL STATISTICAL SOCIETY (at Royal Society of Arts), at 5.15.—D. Caradog Jones: Housing in Liverpool: A Survey by Sample of Present Conditions.

ZOOLOGICAL SOCIETY OF LONDON, at 5.30.—Major S. S. Flower: Exhibition of Photographs of Gorilla, Elephant-Seals, and other Animals now in the Carl Hagenbeck Tierpark at Stellingen near Hamburg.—Col. A. E. Hamerton: Remarks on Trypanosomiasis in Relation to Man and Beast in Africa.—A. D. Middleton: The Ecology of the American Grey Squirrel (*Sciurus carolinensis*) in the British Isles.

LONDON NATURAL HISTORY SOCIETY (at Winchester House, E.C.), at 6.30.—Discussion on Parasitism in Nature.

ROYAL PHOTOGRAPHIC SOCIETY OF GREAT BRITAIN, at 7.—Rev. H. O. Fenton: Spain Calling.

WEDNESDAY, MAY 21.

ROYAL MICROSCOPICAL SOCIETY (Special Meeting) (at King's College, Strand), at 3.—An Exhibition and Demonstration of the Latest Types of Metallurgical Instruments and Apparatus.—At 7.—Prof. Nils E.

Svedelius: The so-called Freshwater Lithoderma.—At 7.45.—Scientific Communications and Discussion on Recent Advances in Current Research and Practice in Microscopic Metallography. (In chair: Prof. C. H. Desch.)

ROYAL METEOROLOGICAL SOCIETY, at 5.—Sir Napier Shaw: An Account of Dr. Moltchanof's Method of Automatic Signalling of the Results of Sounding of the Upper Air.—Sir Gilbert T. Walker: Seasonal Forecasting.—A. C. Best: Instruments for Obtaining Dry and Wet Bulb Temperatures.

ROYAL SOCIETY OF ARTS, at 8.

FOLK-LORE SOCIETY (at University College), at 8.—A. D. Lacaille: The Bull in Scottish Folklore: Place-names and Archaeology.

EUGENICS SOCIETY (at Royal Society), at 8.30.—Raghu Vira: Eugenics in Sanskrit Literature (Lecture).

THURSDAY, MAY 22.

ROYAL MEDICO-PSYCHOLOGICAL ASSOCIATION (at B.M.A., Tavistock Square), at 3.—Dr. A. A. W. Petrie and others: Discussion on American Psychiatry and the Practical Bearing it may have in the Application of Recent Local Government and Mental Treatment Legislation.

ROYAL SOCIETY, at 4.30.—Prof. G. H. Parker: The Ciliation of the Fallopian Tube.—Dr. D. Keilin: Cytochrome and Intracellular Oxidase.—L. E. Bayliss, E. Boyland, and A. D. Ritchie: The Adductor Mechanism of Pecten.—Prof. H. E. Roaf: Visual Acuity in Light of Different Colours.—To be read in title only.—Sir Charles Sherrington and J. C. Eccles: Numbers and Contraction-Values of Individual Motor-Units examined in some Muscles of the Limb.

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

FRIDAY, MAY 23.

PHYSICAL SOCIETY (at Imperial College of Science and Technology), at 3 and 5.15.—Discussion on Magnetism.—Sir Alfred Ewing: Ferro-Magnetism and Hysteresis.—Dr. E. C. Stoner: Magnetism in the 20th Century.—Prof. H. S. Allen: Magnetism and the Quantum Theory.—Prof. C. G. Darwin: The Polarisation of the Electron.—W. Sucksmith: The Gyromagnetic Effect and Paramagnetism.—F. C. Powell: On the Change in Size of a Ferromagnetic at the Curie Point.—Prof. W. Peddie: Magnetisation and Temperature in Crystals.—Prof. W. Weiss and Dr. R. Ferrer: Sur l'aimantation et saturation des ferrocobalts et des nickelcobalts et les moments atomiques des trois métaux.—Prof. W. Gerlach: Über neue Zusammenhänge von magnetischen u. elektrischen Erscheinungen.—Dr. P. Kapitza: Methods of Experimenting in Strong Magnetic Fields.—Dr. W. L. Webster: On Magnetostriction and Change of Resistance in Single Crystals of Iron and Nickel.—Dr. L. F. Bates: Observations on the Specific Heats of Ferromagnetic Substances.

INSTITUTE OF CHEMISTRY (Edinburgh and East of Scotland Section) (jointly with Edinburgh and East of Scotland and Glasgow Sections of Society of Chemical Industry) (at Heriot-Watt College, Edinburgh), at 6.—Prof. J. Kendall: Chemistry in Naval Warfare.

ROYAL SOCIETY OF MEDICINE (Epidemiology Section) (Annual General Meeting), at 8.—Dr. P. Stocks: Immunity Changes in Measles and Whooping-Cough.

ROYAL INSTITUTION OF GREAT BRITAIN, at 9.—R. S. Whipple: Some Scientific Instrument Makers of the 18th Century.

SATURDAY, MAY 24.

LINNEAN SOCIETY OF LONDON, at 5.—Anniversary Meeting.

INSTITUTION OF ELECTRICAL ENGINEERS (Meter and Instrument Section) (at Leamington Spa).

INSTITUTE OF CHEMISTRY (Edinburgh and East of Scotland Section) (jointly with Edinburgh and East of Scotland and Glasgow Sections of Society of Chemical Industry) (at Edinburgh) (continued from May 23).

PUBLIC LECTURES.

TUESDAY, MAY 20.

UNIVERSITY COLLEGE, at 5.30.—Prof. Nils E. Svedelius: The Bearing of Modern Researches on Algae, especially Rhodophyceae. (Succeeding Lectures on May 22 and 23.)

BIRKBECK COLLEGE, at 6.—Dr. A. Mansbridge: The Dedication of Life (Haldane Memorial Lecture).

WEDNESDAY, MAY 21.

INSTITUTION OF ELECTRICAL ENGINEERS, at 5.30.—J. F. Kayser: Permanent Magnets and Magnet Steels (Armourers and Brasiers' Company Lectures). (Succeeding Lectures on May 28 and June 4.)

THURSDAY, MAY 22.

INSTITUTE OF PATHOLOGY AND RESEARCH, ST. MARY'S HOSPITAL,Paddington, at 5.—Prof. C. A. Lovatt Evans: Stages in the Investigation of the Physiology of the Heart.

CONGRESSES.

FRIDAY, MAY 16.

SOCIETY OF MEDICAL OFFICERS OF HEALTH (at Harrogate), at 4.—Discussion on Rheumatism in its Public Health Aspects.

MAY 19, 20, AND 21.

INTERNATIONAL CONGRESS ON MALARIA (at Algiers).

MAY 26 TO 28.

CONGRESS OF LEGAL MEDICINE (at Paris).