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The Development of Cotton-growing in the British Empire.[1]

IN the years before the War, the exportable surplus of cotton from the United States was well over 4000 millions of pounds, or 8 millions of bales of 500 lb. each. At the present time it is only about $4\frac{1}{2}$ millions of bales (in very approximate figures), and there does not seem much possibility of any increase. This is due to various causes, chief among which may be mentioned (1) the ravages of the cotton-boll weevil, which has now, after thirty years have passed since its first invasion, spread over the whole cotton-growing region of the Southern States; and (2) the fact that the United States are every year consuming more and more cotton for the supply of their own mills. The demand for cotton goods in America seems insatiable, and is one of the principal factors in bringing about the present unfortunate situation in the British cotton industry.

American cotton, the fibre (or staple) of which is from an inch to an inch and one-eighth in length, provides the enormous bulk of the supply for Lancashire, the mills of which are constructed to deal with cotton of this length, and cannot at a moment's notice be altered to suit any other kind. Nor is there any other kind available in sufficient quantity, to say nothing of the fact that the demand is for goods of the present quality, which could not be equalled by spinning a cotton of shorter staple. The confusion of the exchanges, the diminished purchasing power of continental nations, and the smaller demand from India, have all contributed to lower the demand for Lancashire fabrics, but can scarcely go much further in that direction; and the consumption in America is increasing. Any rise in the Old World demand would cause the shortage to be felt even more acutely than it is, and even at present it is a very serious matter, which is reflected in the very high price at which cotton stands. American middling (the standard of the market) is now (Nov. 8) at 19·28*d.* per lb., against an average of 6·46*d.* in 1914.

In these circumstances the increased production of cotton of staple approximately equal to middling American, and elsewhere than in the United States, has become an urgent necessity, if the greatest manufacturing industry of Great Britain—upon which it is estimated that ten millions of people are dependent—is not to fall upon very evil days, which may mean widespread unemployment and distress. Among the most obvious countries in which to set to work to remedy the matter are those comprised within the British Empire. Dependence upon them for the supply of raw cotton would also bring other advantages in its

[1] Empire Cotton Growing Corporation. Report of the Administrative Council. Presented at the second annual general meeting on October 10.

train—it would give a fillip to colonial development, it would reduce the payments to be made to the United States, and would save paying in depreciated currency. Already for twenty years the British Cotton Growing Association has been devoting much money and effort to this object, and with considerable success—to such an extent, indeed, that the first and most difficult corner has been turned in several of the colonies, where cotton is now established among the possible crops that may be grown for profit. For some time, however, it has been felt that still greater and more widely organised effort is needed, and with this object in view there has been formed the Empire Cotton Growing Corporation, the sources of the funds of which are a capital grant from Government and a compulsory levy of 6*d.* upon every 500 lb. of cotton purchased by spinners. The second annual meeting has just been held, under the presidency of Lord Derby.

Our thoughts turn naturally and first of all to India, as the second largest producer of cotton in the world. At present, however, that country counts for little so far as Lancashire is concerned, though producing every year some 4½-5 million bales. Only 243,000 were sent to Great Britain in the year ending July 31 last, and only 107,000 were consumed. The bulk of the cotton, which is mostly of short staple and poor quality, is used in Indian mills, or exported to Japan, and to a less degree to the continent of Europe. The locally made cloth, though somewhat coarse in texture, is of excellent wearing quality, and satisfies at a moderate cost a great part of the local demand.

As there seems to be small chance of growing in India within a short time large quantities of the longer-stapled cotton which Lancashire needs, attention must be directed to Africa and Australia. The Asiatic portions of the Empire outside India are in general too wet for the successful cultivation of cotton upon the large scale, whilst the West Indies have already devoted much of their small available area to the production of Sea Island cotton, which has the longest and finest fibre of all. The market for this cotton is but a small one, and the few thousand bales which are exported from the West Indies supply practically all of its requirements.

By far the largest producer in Africa, and one of the most important in the world, on account of the fine quality and long staple of its cotton, is Egypt. Recent political changes, however, have excluded this country from the Empire, and it remains to be seen whether the effect of these may not be to make even worse the present difficult situation in cotton, by involving a falling-off in production, or a deterioration of the quality or length of staple.

In the rest of Africa the cultivation of cotton for export is still comparatively new, and that it exists at all is due to the work of the British Cotton Growing Association referred to above. Cotton-growing is now becoming of serious importance in the Sudan, in Uganda, and in Nigeria, while South Africa, Tanganyika, and other parts are making a good start. In all of them the export is increasing, and in Uganda it now reaches the respectable figure of about 90,000 bales annually (Lancashire now uses about 3 million bales of American cotton). The important fact is that the corner has been turned, and many people know that cotton can be cultivated to a profit in these regions, so that others will probably follow their example, and the export will increase. After having cultivated cotton for some years, people will be less likely to abandon it in the event of an unpropitious year, and the cultivation will be much more likely to be permanent.

While in tropical Africa the crop is mainly in the hands of the natives of the country, there appears to be a good prospect that portions of South Africa may offer good prospects and suitable conditions for cultivation by people of European descent.

Finally, we must consider Australia, where the cultivation of cotton is carried on by white men. Queensland and New South Wales are proving to be excellently well suited to the crop, and the principal thing that remains to be seen is whether the policy of a "white Australia" will allow of enough labour for important extension. If this extension can take place, Australia should become a factor of serious importance upon the cotton markets.

The import into Lancashire of Empire-grown cotton is as yet but small compared to the enormous quantities arriving from the American continent, north and south, but it is by no means unimportant, and there is every reason to hope that at no very distant period, under the fostering care of the Empire Cotton Growing Corporation, it may reach a million bales, or about a quarter of the consumption.

The work of the Corporation is at present in its initial stages. A separate committee is at work in India upon somewhat similar lines, aided by a cess of 4 annas on every bale of cotton used or exported. Specialists have been appointed to report on prospects and conditions in South Africa and elsewhere, and some of the African colonies are being helped by grants made to their agricultural departments for the express purpose of work upon cotton under the supervision of specialists appointed by the Corporation. Research is under way in St. Vincent, grants-in-aid are being made to institutions conducting research in Great Britain, and the question of establishing a research station in some cotton-growing country is under consideration. A number of studentships have been given, and the men are being trained at the Imperial College of Tropical Agriculture, Trinidad, at Cambridge, and elsewhere, while some of those who have finished their training are being employed in the African and other colonies in supervising work with cotton under the charge of the specialists. A large illustrative exhibit is being prepared for the British Empire Exhibition at Wembley next year, a journal is being started under the editorship of Dr. J. C. Willis, F.R.S., and in many other ways the Corporation is settling to work at the gigantic problem before it.

It is clear that the activities of the Corporation will be likely to result in a considerable demand for men of the right kind, and at present there is difficulty in finding these. Highly trained agriculturists with knowledge of cotton-growing are difficult to discover, nor does the supply of young men who have taken a degree in pure science and followed this with some agricultural training meet the demand which at present exists in this new branch of scientific tropical agriculture.

The Forests of India.

The Forests of India. By Prof. E. P. Stebbing. In 3 vols. Vol. 1. Pp. xv + 548 + 27 plates. Vol. 2: *The Development of the Indian Forest Service.* Pp. xii + 633 + 36 plates. (London: John Lane, The Bodley Head, Ltd., 1922–1923.) 42*s.* net each.

PROF. STEBBING'S work deals with the history of forest conservancy in India from the time of the recent Post-Tertiary period to the present time. In volume i. he gives the history from the earliest date to the year 1864; in volume ii. from 1864 to 1900; the period 1900 to the present time is reserved for volume iii., not yet published. The matter assigned to volume i. is further divided into four sub-periods, the last of which comprises the years 1857–1863. Volume ii. is divided into two sub-periods, the first of which comprises the years 1864–1870. The author then, in a way, throws these two sub-periods together again and says that the fourteen years, 1857–1870, witnessed the true foundation of forest conservancy in the different provinces of the Indian Empire.

In the early part of volume i. the general features of India are indicated; its geography, geological features, climate, the distribution and the general character of the forests at the time of the arrival of the English in India. Fire, shifting cultivation, and careless utilisation had considerably reduced the area of the forests and changed their composition, a process which went on, practically unchecked, until the middle of the nineteenth century. The East India Company periodically directed attention to the mischief and urged the adoption of measures to stop it, but the Government of the country did not take action until the Bombay Dockyards ran short of timber for naval construction. A timber agency was set up early in the nineteenth century, but abolished again in 1823, in consequence of its arbitrary proceedings. For some time after this, any small progress was due more to the exertions of active individuals in the services than to the Government as a whole. Among these Mr. Conolly, the Collector of Malabar, stands out. He started the well-known Nilambur teak plantation in 1843. This was so successful that it proved the possibility of making forest conservancy in India financially profitable. Other examples are the activity of Dr. Gibson in Bombay, Dr. Cleghorn in Mysore and Madras, and Dr. Wallich, Capt. Tremenheere, and Mr. Colvin in Burma. These officers and many others did, no doubt, a great deal of good, but their efforts were disjointed; however, they created a feeling that action on a definite plan was wanted.

In 1855 Lord Dalhousie took up the matter. His first step was to appoint Dr. Brandis superintendent of the Pegu teak forests. The latter joined in Burma in 1856, and, supported by Major Phayre, the Commissioner of Pegu, during the following six years he saved the Lower Burma teak forest from the threatening destruction. Soon after the effect of the Mutiny had somewhat subsided, the Government of India began to occupy itself with the question of more effective forest conservancy generally. Dr. Cleghorn was called up from Madras in 1861 to advise about forest conservancy in Upper India, and a year later Dr. Brandis (it is said on Dr. Cleghorn's suggestion) was brought up from Burma to join in the work. In 1864 the Government, with the approval of the Secretary of State for India, established a regular Forest Department with Dr. Brandis as first Inspector-General of Forests.

Dr. Brandis was a man of science, of great knowledge and endowed with a remarkable working power. He had recognised in Burma that lasting benefit could not be achieved without placing the forest business on a legal basis, and he succeeded in having a special Forest Act passed in 1865. That Act had, however, a great defect: it did not provide a legal inquiry and regulation of rights of third persons in the areas proposed for permanent State forests. Hence, in 1868, Brandis proposed a revised Act, and this proposal led to a protracted discussion which did not end until 1878, when the Indian Forest Act passed the Legislative Council. It is still in force with some minor additions, but special Acts were passed for Burma and Madras based on the same principles as the Indian Act but providing for some provincial differences. All these Acts give power to inquire into, regulate, and, if necessary, commute the rights of third persons in areas declared or proposed as Reserved State Forests; to establish village forests to be managed for the benefit of local communities; to protect the forests generally as well as their produce; to organise the administration and working of the forests, and allied matters.

Brandis, on taking charge of the Department, found the existing staff sadly deficient. There were some excellent administrators in it, mostly military officers, including medical men, but there was little knowledge of systematic management with the object of securing a sustained yield in the future. His plan, from the outset, was to obtain a sufficient number of scientifically trained officers, to start the treatment of the forests on the right lines, and to utilise them for the training of Indians to fill the posts of rangers and foresters, promotion to the superior grade being open to those who were fit for it. There being, at that time, no opportunity in India or in Britain to acquire a high standard of scientific forestry, Brandis proposed to send young Englishmen for the necessary instruction to the Continent, Germany and France, where systematic forest management had been practised for more than a century. In the meantime the service in the several provinces of India was organised as well as possible. The formation of Reserved State Forests was commenced, the methods of exploitation improved, the general protection of the forests effected, and especially fire protection commenced, the latter being inaugurated successfully by Capt. Pearson in the Central Provinces. Shifting cultivation in the valuable parts of the forests was restricted or at any rate regulated, taungya teak cultivation in connexion with shifting cultivation introduced in Burma, whence it has spread to other parts of India and produced highly important results.

From the very beginning Brandis drew up preliminary working plans for the forests which he visited, a practice which he continued up to the time of his leaving India. Other officers followed his example, but, as the administration had to a considerable extent been provincialised, there was no security for the plans being executed. When Dr. Schlich took over the Inspector-Generalship from Dr. Brandis in 1881, he recognised that, to secure a continuous yield from the forests in the future, steps must be taken to push on the preparation of working plans based on the principle of a sustained yield, and especially to secure the execution of the plans when once sanctioned by Government. He obtained the sanction of the Government of India and of the Secretary of State for India for the establishment of a Working Plans Branch under the supervision of the Inspector-General, assisted by an Assistant Inspector-General. The plans were prepared under the direction of the local governments, but the Inspector-General had to be consulted as to the lines on which they were to be drawn up, and, when once approved by the local government, he was kept informed of the progress of execution, so that he could direct the attention of the local government to any deviation from the sanctioned provisions. It was foreseen at the time that, as the operations of the Department developed, the control would have to be handed over to the local authorities, and this has now actually been done. The establishment of this branch was, as Prof. Stebbing states in volume ii., considered "an epoch-making move forward." As a result nearly all important forests are now worked under the provisions of well-prepared plans; moreover, the yield capacity of the forests became known and can safely be worked up to, while a great store of valuable information bearing on the silviculture and general management of the forests was put on record. It is not too much to say that the establishment of the Working Plan Branch was a forerunner of the Forest Research Institute at Dehra Dun, which, however, did not come until twenty-two years afterwards.

Prof. Stebbing deals in detail with the development of the education of the staff, both superior and subordinate. The recruits for the former continued to be educated on the Continent until 1886, but in 1885 the first School of Forestry in Britain was opened at Cooper's Hill. The organisation of this was entrusted to Sir William Schlich. It remained at Cooper's Hill until 1905, when it was transferred to the University of Oxford. As soon as a sufficient number of duly qualified teachers of forestry had been secured, the establishment of an Indian School of Forestry at Dehra Dun was effected, in 1878, for the training of the ranger class of officers. It was gradually improved, so that by 1900 it had been brought up to a standard which made it possible to undertake the instruction of the recruits of the provincial part of the controlling staff. Indeed, it is likely that soon the whole of the superior staff will be educated at Dehra Dun.

Prof. Stebbing says in the preface to volume ii. that the fourteen years, 1857 to 1870, witnessed the true foundation of forest conservancy in the different provinces of the Indian Empire, and that the work which was undertaken during the period 1871–1900 was the natural corollary and outcome of the lines laid down between 1857 and 1870. This is, in our opinion, an exaggerated view, because, as has been indicated above, several of the most important measures which secured the success of the whole undertaking were conceived and introduced during the period 1870–1900. Not only was all the spade-work done during the latter period, but also rational forest conservancy became an established fact. Not far short of 100,000 square miles had definitely become permanent State forests; the greater part of these were worked according to the provisions of well-prepared working plans; more than half the area was protected against the annually recurring forest fires; most of these areas had been surveyed and mapped; the education of the staff had reached a high standard; and, last but not least, a remarkable amount of research had been accomplished during the period, as evidenced by such works as Brandis's "Forest Flora of North-West and Central India," a book of such excellence that the author was forthwith elected a fellow of the Royal Society; Gamble's "Manual of Indian Timbers" and his great work on Indian "Bamboos"; and Baden Powell's "Forest Law." Nor should it be forgotten that the greater part of the material with which Brandis dealt in that monumental work entitled "Indian Trees" was collected during the second half of last century, although the book was not published until 1906. It would lead too far to mention works on forestry proper. The *Indian Forester* was started by Sir William Schlich in 1875. Prof. Stebbing calls it a mine of information from a perusal of which a great deal is to be learned. A great quantity of observations on the silviculture of Indian trees is incorporated in numerous reports, and it has only lately been collected and made available to foresters generally. Unfortunately, the establishment of the Forest Research Institute at Dehra Dun was too long delayed, but what part of the Empire has not sinned in the same manner?

Twenty chapters of volume i. and ten chapters of volume ii. are devoted to a description of the progress in forest conservancy in the several provinces of India. The last chapter of volume ii. contains an appreciation of three Inspectors-General of Forestry. Prof. Stebbing gives the text of resolutions by the Government of India acknowledging the services of Sir Dietrich Brandis and of Mr. Ribbentrop, and remarks that no such resolution was passed acknowledging the services of Sir William Schlich. The latter statement is not correct, as a resolution acknowledging the valuable and distinguished services of the last-mentioned was passed by the Governor-General in Council on February 7 and published in the *Gazette of India* of February 9, 1889.

Apart from some passages which might be questioned by past or present members of the Indian Forest Service, Prof. Stebbing has produced a very full account of the development of Indian forest conservancy up to the year 1900. It is based on the study of a vast number of works and writings, among which Ribbentrop's "Forestry in British India" takes a prominent place. A rainfall map is attached to volume i., and a general map of India to volume ii. Sixty-three artistic illustrations are inserted, and they serve as pleasing resting-places during the perusal of the book.

Cambridge Biographies.

Alumni Cantabrigienses: a Biographical List of all known Students, Graduates, and Holders of Office at the University of Cambridge, from the Earliest Times to 1900. Compiled by Dr. John Venn and J. A. Venn. Part 1: From the Earliest Times to 1751. Vol. 2: Dabbs—Juxton. Pp. v+492. (Cambridge: at the University Press, 1922.) 7*l.* 10*s.* net.

THE second volume of this monument of industry and antiquarian research carries the list of members of Cambridge University prior to 1751 down to the name of Juxton. The first four volumes, covering the whole of the early period, are to be published by the end of next year, and the editors now ask for additions and corrections to the data already published.

In the present volume, among men of science of repute we note the names of De Moivre, a Protestant refugee from France, and Sir Kenelm Digby, one of the original members of the Royal Society, who was at one time banished to France; Thomas Gale, regius professor of Greek and first secretary to the Royal Society; J. Flamsteed, first Astronomer Royal, and Jeremiah Horrox, who predicted and observed the transit of Venus in 1639; Gilbert, the physicist, and William Harvey and Glisson among many distinguished members of the medical profession. Of those who combined eminence in two distinct branches of science may be mentioned Dacres, who was professor of geometry and censor of the Royal College of Physicians. Of those known more widely in a different sphere we note John Dryden, who was discommuned for contumacy to the Vice-Master of Trinity; the Duke of Northumberland, Chancellor to the University in 1551, who was executed on Tower Hill; N. Eaton, first master at the school in Cambridge, Mass., which afterwards became Harvard College—and John Harvard himself. Orlando Gibbons, Thomas Gray, George Herbert, Robert Herrick, and Ben Jonson bear witness to Cambridge's continued love of the muses; the name of Judge Jeffreys strikes another note, as also do the names of Erasmus, Thomas Gresham, founder of the Royal Exchange, and Thomas Hobbes.

Amongst distinguished Cambridge families we find the Darwins and the Howards. The latter in their history bear witness to the religious disputes which have in the past left their stamp on Cambridge as on England. Martyrs on both sides were educated there. The position of Cambridge in the Civil War is suggested by the names of Fairfax, Fleetwood, Hesilrig, and Hollis, though the Earl of Montrose represents the other side. Among the points of human rather than of historical interest we may note the sentence of transportation on Henry Justice for stealing books from the University Library, and the history of Adam Elliot, a slave to

Moorish pirates. Francis Dawes, who hanged himself with the chapel bell-rope, must have had a grim sense of humour. Lastly, the modern touch giving the sense of continuity in the history of Cambridge is supplied by William Hawteyne, who went out as an army chaplain in Flanders and Germany.

The *Quest* Expedition and its Lessons.

Shackleton's Last Voyage: the Story of the "Quest." By Comdr. Frank Wild. From the Official Journal and Private Diary kept by Dr. A. H. Macklin. Pp. xvi + 372 + 100 plates. (London, New York, Toronto and Melbourne: Cassell and Co. Ltd., 1923.) 30s. net.

CLOSE upon the heels of the excellent "Life of Sir Ernest Shackleton," by Dr. H. R. Mill, comes the story of his last voyage. It is told by his old comrade in adventure, who took part in all the expeditions with which Shackleton was connected, and whose experience of Antarctic life was even greater than Shackleton's. Commander Wild is assisted in his literary labour by a member of the expedition who seems to have been invaluable at every turn, Dr. A. H. Macklin.

The tale is told in a plain, straightforward manner which reflects the character of the writers, who ask neither for eulogy nor for sympathy, although both will be readily forthcoming. Of the success they hoped for there was but little, of the bitterness of thwarted plans there was much, but there is small mention of either. The events of the voyage are duly chronicled, and comment is usually reduced to the minimum. The main features of these events are already well known through the medium of the daily press, but the book adds to them so much in the way of personal detail, and the pros and cons of the decisions which were made, that we recognise at once the inadequacy of a press narrative.

The expedition was unfortunate almost throughout, and the story resolves itself into a tale of misfortunes endured or overcome, many but not all of which were unavoidable. The crowning misfortune, the loss of its leader before the expedition had even reached its cruising ground, would have wrecked the future of most expeditions, and it is this which absorbs one's interest and overshadows the other incidents to a great extent. Every reader, and especially those with Antarctic experience, will admire the spirit of Wild's decision to "carry on" after the death of the leader; indeed, in the circumstances as given in this book, none would have blamed him had he turned back.

It is the duty of every leader of an expedition to write its narrative, the tale of the things done; but as he writes it we suspect that he writes a second one in his own mind, the tale of the things left undone and the things he did unwisely, and there can be no doubt that the one which does not reach the printer is the more valuable of the two. It is in no unfriendly spirit, and with the greatest admiration for all the actors in the story, that we propose to examine some of the causes of misfortune, causes which must be writ large in Commander Wild's own mind as things he would avoid next time. It is the business of those interested in polar exploration to extract the lessons of the past as well as to applaud its successes.

With so popular a leader, so varied a programme, and so small a ship, it was perhaps inevitable that the expedition should have become the prey of the sensation-monger reporter before it started. Such a fate should rank perhaps as a nuisance rather than as a misfortune, but it was scarcely fair either to the leader, harassed with the thousand details of preparation, or to the members, most of whom had their polar spurs yet to win, to find the press following every movement, publishing every plan, and "featuring" every detail down to the ship's cat.

Beside such a small matter, the enforced change of plans at a late date was a very real misfortune. The fundamental character of this change, for which but a few months was available, is perhaps not appreciated by the general reader, to whom the Arctic and the Antarctic are merely opposite poles of cold and unpleasantness. The change was really from a short North Atlantic voyage followed by sledging exploration in the Beaufort Sea—essentially a land expedition, in fact—to an oceanographical cruise in the stormiest seas of the world, essentially a ship expedition. We deplore the change for other reasons, for we believe that a leader with the qualities of Shackleton, and followed by the men he had selected, would have made great discoveries in the blank spaces of the Beaufort Sea. Indeed, only the most urgent circumstances could have prevailed on the leader to make such a change, circumstances not at all covered by the phrase, "as it was too late to catch the Arctic open season the northern expedition was cancelled."

Even so, we think that success would have been somehow achieved were it not that the element of hurry now came doubly into the preparations, an element which must have been responsible for the totally inadequate survey of the *Quest's* boilers and engines, the defects in which crippled the expedition from the moment it left England. It is sad to read, for example, that only after infinite delay and expense, enforcing vital changes in the plans—in fact, only after reaching South Georgia—was it found on consulting the ship's record that the boilers were thirty-one years old, and Commander Wild marks his surprise and chagrin by printing the fact in italics. While these fundamentals were somehow overlooked, the ship was equipped with an array of special fittings such as no former polar ship could boast—enclosed bridge, clear-view screens, gyroscopic compasses, double set of wireless, etc.—all very helpful, no doubt, but one can imagine the remarks of the ship's officers when, though surrounded by these devices, they had to nurse a leaky boiler and a crank-shaft out of the true.

The initial cost of the *Quest*, a small wooden vessel of 125 tons, was 11,000*l.*, and we imagine that before she returned at least as much again must have been spent upon her. Even allowing for the fact that she was bought when the shipping market was at its peak, it is clear that oceanographical or polar expeditions are ruinously expensive, nor can former expeditions present much more satisfactory balance-sheets.

The *Discovery* was designed and built in 1900 for Antarctic exploration, and cost more than 50,000*l.*; she was sold afterwards for a fraction of that sum. She is now being reconditioned at a cost comparable with her first cost, to continue, after twenty years, the work for which she was originally designed. During that period Scott, Shackleton, and Mawson, to mention only the chief leaders, have wanted her and had to put up either with inferior ships or have lost heavily over buying and selling. Meanwhile, the only ship ever built specially for the Antarctic has been sealing or dry-rotting in dock. Manifestly we are here touching upon what might almost be called a scandal, but it is one for which no one in particular is responsible, unless it be the companies who make large profits by selling and buying exploring ships. The real scandal is that polar exploration is so little organised, the efforts are so spasmodic and independent, that it was no one's business to keep the *Discovery* after her first voyage and charter or lend her when she was again required.

That, we believe, is the real lesson to be learnt from the story of the *Quest*; and it is a lesson, not for the Shackletons and Wilds of the future, but for us stay-at-homes who urge them on, who even subscribe towards their ventures, but take no steps to secure continuity from one expedition to the next.

The book is well illustrated, but is extraordinarily deficient in good maps. It is time that publishers, if not their authors, realised that adequate maps are essential to such books and improve their selling prospects. Perhaps the most valuable part of the book is the medical appendix written by Dr. Macklin, in which he gives the most up-to-date summary of medical conditions on a polar expedition, with advice drawn from his own experience on such subjects as scurvy, frost-bites, and sledging rations.

F. Debenham.

Metallurgical Furnaces.

The Flow of Gases in Furnaces. By Prof. W.-E. Groume-Grjimailo. Translated from Russian into French by Leon Dlougatch and A. Rothstein. Translated from the French by A. D. Williams. With an Appendix upon the Design of Open-Hearth Furnaces. Pp. xxi+399. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1923.) 27*s.* 6*d.* net.

THE construction of furnaces for metallurgical purposes has been guided in general by rule of thumb, practical experience having shown a particular furnace to work well, and a similar design being adopted in new plant, without any established principles to serve as a guide to the designer. In 1911 there appeared an important work in Russian, by Prof. Groume-Grjimailo, in which an attempt was made to place the subject on a scientific basis. Being translated into French in 1914, and introduced to the French public by Prof. Le Chatelier, this novel treatise attracted much attention, and it has now been made available, in an extended form, to the English-speaking world. It should be studied with care wherever furnaces are used. The loss of heat in most metallurgical furnaces is large, and economies in this direction are of great importance in the improvement of industry, especially in view of the great increase in the cost of fuel.

The guiding principle of the work is recognition of the fact that the densities of hot and cold gases differ so much that a mass of flame passing through a furnace may be treated as if it were a light fluid, floating on the heavier mass of gas at a lower temperature beneath it. It is then possible to apply the laws of hydromechanics to the case of furnaces. For purposes of study and demonstration, sectional models of the furnaces are made, enclosed between sheets of plate glass, water being introduced, and a light liquid, such as kerosene, coloured for distinctness, being then admitted through the gas ports. It is then easy to see how the light liquid, representing flame, distributes itself through the furnace. The difference between the efficiencies of updraught and downdraught kilns is at once made evident by this method, and the use of such models is becoming common. Many examples are given by the author of furnaces which were unsatisfactory in their working, but became efficient on being reconstructed in accordance with these principles. The consequences are worked out quantitatively, and formulæ are arrived at which may be used by the furnace designer.

It may be suggested, however, that the author scarcely takes sufficient account of radiation as a means of supplying heat to the objects in the furnace. The translator has added greatly to the value of the work by supplying long appendices on the design of Siemens furnaces, hot-blast stoves, and boiler settings, in which the author's principles are applied to a large number of concrete cases, with an abundance of numerical data. Tables of thermal data and curves giving the heat capacity and calorific intensity of some of the most typical gaseous and liquid fuels complete a book which should exert a great influence. C. H. D.

Our Bookshelf.

Periodicals of Medicine and the Allied Sciences in British Libraries. By Prof. R. T. Leiper; with the collaboration of H. M. Williams and G. Z. L. Le Bas. Pp. vi+193. (London: British Medical Association, n.d.) 10*s.* 6*d.*

THE provision of Union Lists of Periodicals filed in our University centres is now recognised to be an indispensable aid to research. Such Lists should be authoritative. They should be issued at frequent intervals and on a uniform basis of compilation. Their type should be kept standing with the view of reducing the labours of their compilers and the cost of successive editions to their buyers. Something has already been accomplished in this direction; but the ground is not yet adequately covered.

Union Lists of Periodicals, however, representing specific branches of knowledge, stand upon a less secure footing. Dr. Leiper's "Periodicals of Medicine and the Allied Sciences in British Libraries" illustrates the difficulties which beset the path of the untrained compiler of these sectional lists in the absence of a printed National Union List covering the whole range of periodical literature. Judged by the "standards which guide professional librarians" (we are quoting from Dr. Leiper's preface), the work before us cannot be regarded as satisfactory, in more than one respect. Wales, for example, is not represented in the List; the Scottish libraries are not represented by the Advocates' Library in Edinburgh, or the London libraries by the Library of the Patent Office. These are serious omissions. We do not, however, propose to justify our criticism further, for to some extent the defects in the List are admitted in the preface. We prefer to meet Dr. Leiper on his own ground. The compiler and his collaborators have grappled manfully with a very difficult task, and have succeeded in producing a work which will be serviceable to students in the field of medical research, provided that they do not lean too heavily upon its bibliographical sufficiency and accuracy. Further, we trust that its publication will serve to promote a higher co-ordination of work among professional librarians—in respect of which, as Dr. Leiper suggests, there is still great room for improvement.

Nickel Ores. By W. G. Rumbold. (Imperial Institute: Monographs on Mineral Resources, with special reference to the British Empire.) Pp. ix+81. (London: John Murray, 1923.) 5*s.* net.

THIS little volume is written in the same way and upon the same lines as its predecessors in the series of Imperial Institute monographs on mineral resources; that is to say, it commences with a brief account of the mode of occurrence and the character of nickel ores, the metallurgy of nickel, and the uses to which this metal is put industrially, followed by a description of the occurrences of nickel ores within the British Empire, and finally of the foreign sources of supply of this metal. The task is in so far rendered an easy one because the author had at hand the well-known report of the Royal Ontario Nickel Commission published in 1917, in which the whole subject is most exhaustively dealt with. This great report is, however, too voluminous for the ordinary seeker after general information, and the present monograph fulfils a useful object in presenting the subject matter in a more convenient and more readily accessible form. It should be added that Mr. Rumbold has done his work very well. The section on the applications of nickel, although brief, is tolerably comprehensive, although more attention might perhaps have been given to nickel-plating, which is becoming of very great industrial importance. In other respects the author appears to have covered the ground very thoroughly; he scarcely does full justice to the important part that Norway has played in nickel production in the past, and, to judge by the bibliography attached, does not seem to have consulted the tolerably extensive Norwegian literature on the subject. Upon the whole, it may fairly be said that the work carries out very well the intention of the series, namely, "to give a general account of the occurrences and commercial utilisation of the more important minerals."

Proceedings of the Aristotelian Society. New Series, Vol. 23: Containing the Papers read before the Society during the Forty-fourth Session, 1922–1923. Pp. ii+289. (London: Williams and Norgate, 1923.) 25*s.* net.

PHILOSOPHY takes account of the meaning of things. At the present time, it is partly occupied with new conceptions of the structure of the material universe, or matter, in terms of theoretical physics. Among the papers in the current issue of the Proceedings of the Aristotelian Society—mainly devoted to dialectical discussions of classical themes or the re-statement of old problems—attention may be directed to three. The Rev. Leslie Walker's "New Theory of Matter"—new, in the sense of its being pre-Aristotelian—is (he says) an attempt to deduce from relatively simple first principles the laws of co-existence and sequence which have been found experimentally to hold good between observed changes in the sphere both of quantity and quality. He finds that the essence of a thing lies in the fundamental structure or ratio—*forma substantialis*—which holds between the potentialities themselves.

Dr. E. S. Russell's "Psychobiology" is a monadistic conception—opposed to the mechanistic or vitalistic view—in which living things appear to show a persistent and enduring individuality of action unparalleled in the inorganic realm: structure and function, he maintains, must be treated as one and inseparable.

Prof. Sellars, in a thoughtful paper on the "Double-Knowledge Approach to the Mind-Body Problem," demands a deepening of our metaphysical categories: there exists, indeed, in Nature a level of causality, of self-determination, which does not easily fit into the traditional interpretation of Nature.

Entomology: with Special Reference to its Ecological Aspects. By Prof. J. W. Folsom. Third revised edition. Pp. vii+502. (London: John Murray, 1923.) 21*s*. net.

PROF. FOLSOM'S well-known text-book gives a clear and concise account of the various aspects of entomology, and is written with the object of meeting the growing demand for a biological treatment of the subject. The present (third) edition includes a considerable amount of new letterpress, with the addition of an opportune chapter on insect ecology, and some 250 titles have been added to the bibliography. Considering the limited size of the book (500 pp.), the author has been remarkably successful in dealing with his subject in a comprehensive manner. An elementary treatment is, of course, only possible within this compass. Entomology, like other branches of science, has made such rapid strides during the last twelve years or so, that it is almost impossible to compress a really adequate work into less than 800 or 900 closely printed pages. There is a great need at the present time for a more advanced book, since works of an elementary nature are tolerably numerous. Among the latter, Prof. Folsom's book is undoubtably one of the best. The author's admirably terse and lucid style is of great value to the beginner, while the up-to-date bibliography, that is appended at the end, serves as a guide to the sources where fuller information is obtainable.

How to Build Amateur Valve Stations. By P. R. Coursey. Pp. 70. (London: The Wireless Press, Ltd.; New York: The Wireless Press, Inc., 1923.) 1*s*. 6*d*. net.

WE can recommend this book to all who want to take advantage of the latest developments of radio telephony. The author is equally at home on the scientific as well as on the practical side of the art, and experts attach weight to his views.

The very simple sets described can be trusted to work admirably on days when the electrical condition of the atmosphere is not very disturbed. A set for use in Great Britain should have a tuning range from 300 up to 2700 metres. This would include the Eiffel Tower time signals, which are usually made on a wave length of 2600 metres, the French "radiola" concerts, which are sent on a wave-length of 1500 metres, the Hague concerts on 1050 metres, the French concerts from "l'École des Postes et Télégraphes" on 450 metres, and the British concerts broadcasted on wavelengths varying between 350 and 425 metres. Careful and accurate descriptions are given of the components of valve receiving sets, the diagrams can be read at a glance, and the many useful practical hints will be welcomed by amateurs.

Labyrinth and Equilibrium. By Prof. S. S. Maxwell. (Monographs on Experimental Biology.) Pp. 163. (Philadelphia and London: J. B. Lippincott Co., 1923.) 10*s*. 6*d*. net.

MANY different views have been held as to the respective functions of the ampullæ, otoliths, and other constituent parts of the internal ear, and any fresh evidence on the subject must be welcome to physiologists. Prof. Maxwell seems to have attained a high degree of accuracy in his experimental methods, especially in dealing with the otoliths. He shows, for example, that compensatory movements to rotations around the longitudinal and transverse axes continue so long as the otolith of the recessus utriculi remains uninjured. He further shows, in the case of the ray, by mechanical pressure upon the otolith in different directions, that it is the displacement of the otolith and not its own pressure which is the actual stimulus, and that it is the direction of the displacement which determines the direction of the compensatory movement. Unfortunately, his experiments leave us completely in the dark as to the reason for the existence of the three semicircular canals and their highly characteristic orientation.

Radioactivity and the Latest Developments in the Study of the Chemical Elements. By Prof. K. Fajans. Translated from the fourth German edition by T. S. Wheeler and W. G. King. Pp. xvi+138. (London: Methuen and Co., Ltd., 1923.) 8*s*. 6*d*. net.

PROF. FAJAN'S book is particularly addressed to chemists, and it gives in a very readable form the important developments in the study of radioactivity, isotopes, atomic numbers, and the structure of the atom which have been made in recent years. The subjects are dealt with briefly, but in a very authoritative manner, and chemical students will find the book of great interest and value. There are references to the literature and an index. The book is well printed and illustrated. One might have wished for a little more detail of experimental methods (*e.g.* in connexion with Moseley's work, which is not described, whereas Aston's apparatus is figured and explained), but in the limits of his space the author has generally made a wise choice of material. The numerical constants in the tables of radioactive series (pp. 21-23) in some cases differ slightly from those adopted in the Report of the International Commission on the Elements (1923).

Geometry Practical and Theoretical, Pari Passu. By V. Le Neve Foster. In 3 vols. Vol. 3: Solid Geometry. (Bell's Mathematical Series for Schools and Colleges.) Pp. xiv+423-585+viii. (London: G. Bell and Sons, Ltd., 1922.) 3*s*. 6*d*.

THIS is the third part of a work of which we have already noticed the first and second parts (NATURE, June 10, 1922, vol. 109, p. 737). Mr. Foster continues to combine the theoretical with the practical, and added interest is obtained by historical references. The scope of the book is indicated by the fact that it deals with parallelepipeds and tetrahedra, lines and planes, gradients, regular solids, and the sphere. There are chapters on the mensuration of prisms, pyramids, and spheres, as well as on solid angles and Euler's theorem. A concluding chapter on the earth is particularly useful and instructive.

We like this volume very much, and think it makes a most useful and pleasant addition to the available elementary literature on solid geometry. S. B.

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.*]

The Gorilla's Foot.

SIR RAY LANKESTER, in his recent book, "Great and Small Things," makes the following statement in the chapter on "The Gorilla of Sloane Street":

"An entirely erroneous figure of the gorilla's foot is given by Mr. Akeley in the *World's Work* of October 1922. He gives valuable observations on the habits of the gorillas made when hunting this animal in the neighbourhood of Lake Kivu, in Central Africa. He made casts of the head, hands, and feet of specimens killed by him. But the cast of the foot is (as shown in a photograph) strangely distorted, and made to present a false resemblance to the foot of man. Since Mr. Akeley was securing specimens of gorilla for the American Museum of Natural History in New York, it is well that his mistake about the gorilla's foot should be corrected at once."

I have examined the cast of the foot made by Mr. Akeley, who states that the cast was made in the relaxed position after rigor mortis had passed away. There has been no retouching or alteration, and the photographs published in *World's Work* give a very fair representation of it. The foot of Mr. Akeley's old male gorilla undeniably differs in many details from that of John, the young "Gorilla of Sloane Street," and still more from that of an infant gorilla formerly in the New York Zoological Park.

Dr. D. J. Morton, an orthopædist, has recently published an important article on the evolution of the human foot in the *American Journal of Physical Anthropology* (Oct.-Dec. 1922), in which the structural contrasts in the skeletons of infant and adult gorilla feet are shown to be connected with the differences in function and in body weight. Mr. Akeley's old male gorilla foot is amazingly manlike in general appearance; his female gorilla foot shows a distinct peroneus tertius muscle. No doubt the great toe could be more or less abducted from the other digits, but the cast represents the foot as it was in the relaxed condition. There is no evidence from the cast that the foot is "strangely distorted, and made to present a false resemblance to the foot of man."

From a copy of this cast which is being sent to the British Museum (Natural History), English naturalists will have an opportunity of judging whether Sir Ray Lankester's criticisms are justified.

WILLIAM K. GREGORY.

American Museum of Natural History,
New York, September 21.

MY "criticisms" quoted by Dr. William K. Gregory refer to a text-figure published by Mr. Akeley in the *World's Work* of October 1922. As to whether this figure gives "a very fair representation" of the cast of the gorilla's foot made by Mr. Akeley, and what precisely Dr. Gregory means by "very fair," we shall be able to judge when the promised copy of the cast is received at the Natural History Museum. My own experience is that a photographic camera turned on to such an object as the cast of the foot of a dead gorilla will yield a misleading, or even a "distorted," picture if special skill has not been exercised in both the posing and the illumination of the photographed object, and also in the manipulation of the camera.

I should be greatly pleased were Mr. Akeley to demonstrate that the foot of the gorilla from Mount Mikeno is, as he supposes, unlike that of the other adult

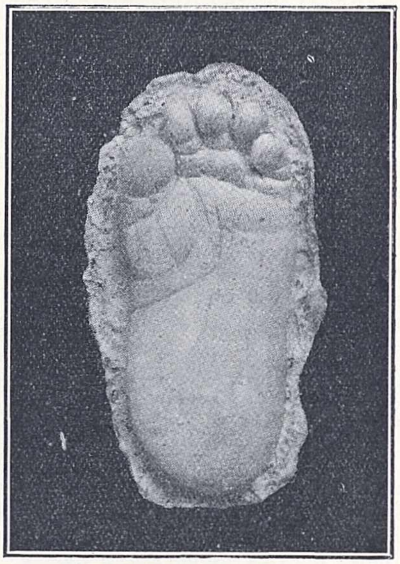

FIG. 1.

gorillas long known to naturalists, as well as unlike that of any known anthropoid.

Fig. 1 is reproduced photographically from that given by Mr. Akeley in the *World's Work* as representing a cast of the foot of a large gorilla, taken immediately after death. It is unlike any other published figure of a gorilla's foot. I place here beside it the figure of the plantar surface of the gorilla's foot (Fig. 2) as recorded by Mr. Pocock, of the Zoological Society of London. I accept this Fig. 2 as correct. It agrees with all other statements and illustrations prior to that of Mr. Akeley.

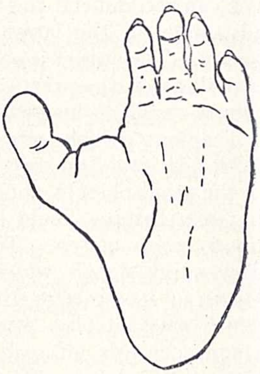

FIG. 2.

The explanation of this discrepancy which appears to me probable is that Mr. Akeley's cast of the foot of the gorilla—reproduced here as Fig. 1—has been accidentally distorted, so that the photograph is misleading. It is highly improbable that Fig. 1 corerctly represents the foot of a normal species or variety of gorilla.

Since writing the above, I have received by the courtesy of the publishers—Messrs. Heinemann—advanced sheets of Mr. Akeley's new book called "In Brightest Africa." My opinion that owing to some unfortunate mistake the cast itself of the gorilla's foot figured by Mr. Akeley is defective and distorted is favoured by the photograph, labelled "A Gorilla's Foot and Hand," which faces p. 230 of the new book. This photograph is not taken from a cast but from the actual foot and hand of a dead gorilla. It shows the plantar surface of the foot, and this differs very widely from the same region as shown in the cast under discussion, which is taken from another specimen. In this new photograph the great toe is large and diverges from the other toes as in my Fig. 2 (here printed). But its terminal phalanx is flexed and the foot is so posed that the great digit projects over and in front of the bases of the other digits and is consequently foreshortened in the photograph. The shape of the plantar surface and that of the heel is *not* that shown in the photograph of Mr. Akeley's cast—but is that already familiar to those who have made a study of the gorilla's foot. It is a happy circumstance that Mr. Akeley presents his readers with conclusive evidence condemning his plaster cast of the gorilla's foot, side by side with the photograph of that misleading production (which faces p. 242). He could not deal more frankly and straightforwardly with the matter than this.

E. RAY LANKESTER.

October 5.

Determination of the Temperature of the Upper Atmosphere by Meteor Observations.

IN a letter published in NATURE for February 10, 1923 (p. 187), I referred to the possibility of determining the temperature of the upper atmosphere on any occasions when the disruption of a meteor has been heard and the time interval between sight and sound has been recorded. I have now to report that I have only been able to learn of two instances which have looked favourable, and that neither of them has yielded useful information.

The first case is that of the meteor of December 21, 1876, which is described in the *American Journal of Science and Arts*, Series III., Vol. 13, p. 166, 1877, and in a paper by Prof. C. U. Shepard, on p. 207 of the same volume, as well as in a paper read by Prof. D. Kirkwood before the American Philosophical Society, March 1877. The meteor was under observation from Kansas to the shores of Lake Erie.

Over the State of Missouri one or more explosions occurred, and the disintegration continued until there was "a large flock of brilliant balls chasing each other across the sky." In some places "a terrific series of explosions were heard." It is clear that the identification of the source of any particular sound is out of the question. The following tantalising observation quoted by Kirkwood is therefore of no service: "Rev. James Garrison, who resides one mile south of Bloomington, noticed by his clock the time of the meteor's disappearance and also that of the subsequent rumbling sound, together with the violent jarring of his house. The interval was 15 minutes, indicating a distance of 185 miles." The implication that the speed of sound is a universal constant is to be noted.

The second case is that of the meteor of July 27, 1894, a very detailed account of which is given by Prof. E. S. Holden in "Meteors and Sunsets" (Contributions from the Lick Observatory, No. 5). It is clearly established that the meteor exploded at a height of about 28 miles and near to Merced, California. The determination of the time of passage of the sound to the Lick Observatory appears from the statements of the observers to be precise enough. Five observers who noted the time at which the sound was heard agree within two or three seconds. For the time at which the explosion was seen there is, however, only one observation with any claim to precision.

The time of explosion (A. F. Poole)	7h. 29m. 45s. $\pm$ 10s.
The time of hearing the report (five observers) .	7h. 36m. 14s. $\pm$ 3s.
Time of passage of sound .	6m. 29s. $\pm$ 13s.

The distance from the observatory to the point at which the explosion occurred is estimated by Holden as 59·3 miles—*i.e.* 95 km., due allowance being made for the height of the observatory above sea-level.

The data imply that the average speed of the sound was 244 ± 8 metres per second, and that the average temperature of the air between 28 miles and 1 mile above sea-level was $148^\circ \pm 9^\circ$ A. (about -193° F.).

In 1894 such an estimate was accepted without difficulty. In 1923 it looks wrong. The most likely place for a flaw is in Poole's observation. There is no statement as to how it was made: if with an ordinary watch an error of a whole minute is not unlikely. With the appropriate amendment the time of travel of the sound becomes 5m. 29s., the speed 289 metres per second, and the temperature 207° A.

Some confirmation is found in the only report received by Prof. Holden in which a single observer states the interval between sight and sound of the explosion. Mr. George Bray saw the whole phenomenon at Santa Clara, and gave the interval as 7¼ minutes. According to Holden's sketch-map, the horizontal distance was 70 miles, the path of the sound was therefore about 75 miles or 121 km., and the speed 278 metres per second. This corresponds with an average temperature 192° A. and is quite plausible, but with the limitations implied by an estimate of 7¼ minutes, little weight can be attached to the result.

I have trespassed so far on your space because I wish to emphasise the fact that any one who has the good fortune to see a meteoric explosion will be doing good service if he notes the time by his watch (writing it down immediately) and listens for the sound. If he is able to compare his watch with a standard clock, so much the better, but from the present point of view the interval is of greater importance.

In conclusion, I should like to thank Miss Williams, assistant secretary of the Royal Astronomical Society, who devoted much time to looking through the literature of meteors on my behalf.

F. J. W. WHIPPLE.

6 Addison Road, Bedford Park, W.4,
October 25.

Experiments on *Ciona intestinalis*.

IN the issue of NATURE for November 3, p. 653, there appears a letter from my old friend and former colleague, Mr. H. M. Fox, in which he records an attempt which he made this summer to repeat Dr. Kammerer's experiments on Ciona. These experiments consisted in inducing an abnormal growth of the siphons of Ciona by repeated amputation. Mr. Fox amputated the siphons of Ciona, but the length of the regenerated siphons was normal.

As Dr. Kammerer took a deep interest in the projected repetition of his experiments on Ciona, and wrote to me twice this summer to learn if repetition were being attempted and under what conditions, perhaps you will allow me to make some remarks on Mr. Fox's letter, as Dr. Kammerer is now in America.

Dr Kammerer, whilst in Cambridge, wrote out a full account of the precautions to be observed in making these experiments. At that time he did not know that Mr. Fox was going to take up the work: another Cambridge biologist had undertaken to do so, but this gentleman was prevented by illness from doing the work. To him, however, Dr. Kammerer had transmitted his information. I understand—Mr. Fox will correct me if I am wrong—that Dr. Kammerer's instructions did not reach Mr. Fox.

In these circumstances it is not surprising to learn that Mr. Fox failed to obtain Dr. Kammerer's results, since he has tumbled into one of the most obvious pitfalls. It may surprise him very much to learn that *Dr. Kammerer got the same results as he did* when, like Mr. Fox, he cut off only the oral siphon. Since the anal siphon remains of normal length and the reaction is of the animal as a whole, the regenerated oral siphon is of normal length also. But *when both anal and oral siphons are amputated in a very young animal,* then long siphons are regenerated. I have a photograph which shows an operated Ciona and a normal one growing side by side in the same tank, and the contrast between the lengths of their siphons is obvious. When Dr. Kammerer returns from America I hope that Mr. Fox will communicate with him and repeat the experiments, observing Dr. Kammerer's precautions, when, I feel confident, he will obtain Kammerer's results.

My confidence is based on the following considerations. Curt Herbst in Germany tried to repeat Dr. Kammerer's experiments on *Salamandra maculosa*; he arrived at the conclusion that although the animal may change colour with environment, yet these changes are temporary, and that therefore it was useless to try to repeat Kammerer's work on the inheritability of these changes. Herbst worked principally on Salamander larvæ. Mr. E. Boulenger in 1919, however, began to repeat Kammerer's work on young metamorphosed Salamanders. I have been privileged to watch Mr. Boulenger's experiments from the beginning, and now in 1923, after four years' work, Mr. Boulenger and I are both convinced that Kammerer is perfectly right so far as the first generation is concerned. Our specimens are not yet, unfortunately, completely sexually ripe.

E. W. MACBRIDE.
Imperial College of Science and Technology,
South Kensington, London, S.W.7.

Globular Lightning.

I AM much interested in the references to lightning in Dr. A. Russell's presidential address to the Institution of Electrical Engineers, and also in the article by Dr. G. C. Simpson in NATURE of November 17, especially where the latter mentions that "the only physical phenomenon yet produced in a laboratory at all approaching ball lightning is the active nitrogen studied by Lord Rayleigh."

It has occurred to me that possibly the ball may be a mass of concentrated nitrogen oxides, and I suggest this because the observations seem to fit in well with the formation and action of such gases.

We know that when air passes through high-tension arc flames in an electric furnace, the nitrogen and oxygen combine to make nitric oxide gas, and that as the gas cools down it takes up more oxygen to form nitrogen dioxide, the speed of combination increasing rapidly with the cooling.

In Norway, and elsewhere, for many years, electric furnaces have been running which aggregate over half a million horse-power and make nitrates from the air in the same way that lightning does. It has been estimated that 100 million tons of nitrogen fixed by lightning flashes fall annually on to the earth's surface.

The energy suddenly released by a flash is enormous, and the potential has to be many millions of volts to tear a way, or a hole, through the air dielectric. May it not be that a very high pressure is suddenly set up, followed by a sudden reaction and chilling effect? If so, then the conditions are extremely favourable to the production of a large amount of nitric oxide and nitrogen dioxide gas in a very concentrated and possibly liquid form.

Whilst moving through the air the outer layer of the gas will gradually oxidise to nitrogen dioxide, which will dissipate, and if the length of travel through the air is long enough it may all dissipate in that way. Occasionally, however, a ball of gas may start from a point so near the earth that some of it is still in concentrated form when it arrives at earth-level.

If a ball of such concentrated gas meets with organic material, such as a haystack or a tree, it would immediately nitrate it and a violent explosion take place. One of the worst accidental explosions that took place in Germany during the War is said to have been caused in that way.

The peculiar smell, which some observers have called "sulphury," may be nitrogen oxides or ozone.

Of course, the point most difficult of explanation is how the gas, if such it be, becomes concentrated into a ball. Perhaps a reader of NATURE can suggest an explanation of that point.

E. KILBURN SCOTT.
38 Claremont Square, London, N.1.

Principles of Psychology.

AN absence from London prevented me from seeing the review that appeared in NATURE of October 13, p. 535, under the heading "Mental Athleticism," of my work "Principles of Psychology"; but I desire now to enter my protest against the ill-usage offered to my book, and to science itself.

I do not speak from mere author's vanity, for I have written this book not for my own glorification, but by way of introducing something into the world of thought that will eventually impinge on every fibre of our civilisation and help to mould the life of man to greater purposes.

When as a young student I set forth with this purpose, *por mares nunca de antes navigados*, I resolved to stake my own intellectual life on the issue, and not to write a line until I had completed the exploration of my problem. That work occupied twenty years of secluded work and intense intellectual effort.

If I am confident now, it is as Pythagoras was confident, for the good reason that he had furnished the complete demonstration of what others had tentatively sought to know.

The review, published anonymously in NATURE, contains a series of statements so wide of the mark as to seem to be almost purposely misleading. My first book did not, as the reviewer suggests, fall stillborn from the press; the whole edition has, in fact, been sold. It is true that by certain "authoritative teachers" here it was received with sneering comment, but it found the most gratifying acceptance in enlightened quarters. The *Revue Philosophique*, which is the most authoritative of all the philosophical magazines, broke its rule of allotting but one page to a review, and devoted to the book twelve times that space in a finely analytical study by Prof. Dugas, himself justly famous in Europe.

So far from finding with your critic, in his incomprehensible statement, that "the solution offered as new is certainly not novel," Prof. Dugas noted especially the "originality" as well as the "profundity" of the work. Of the present volume he says: "I live with your *Principles* just now. . . . I am more and more struck by the philosophic character of your psychology." Amongst many others Ribot and Boutroux, both world-renowned, expressed themselves in similar terms. Boutroux was "astonished" at the scope of the book, and declared, "the conception is as scientific as the exposition is lucid."

I mention these, for I recognise that in academic circles here it is the custom to "drink the label," but I give no value to mere authority; I attach the utmost importance, however, to the serried march of my own arguments proceeding from the deepest ascertainable base in regular succession to the conclusions offered.

Would any one guess from the statements of the reviewer that this presentation of psychology, so far from depending on my personal feelings, is entirely objective in conception, and that I do not ask the reader to take my series of "Fundamental Processes" at my word, but offer the demonstration of their "necessity and sufficiency" in an exposition of which the meticulous and exhaustive character may be excused only by the paramount desire for rigour?

The reviewer is wrong even when he attempts to soften a disparaging note: "The choice of the name [Alētheian system] seems to imply a slight on other systems, but probably nothing of the kind is intended." What I intend to imply is that this work stands to other systems in a relation corresponding to that of Pasteur to the writings of the physicians of Louis XIV., or that of Galileo to the Schoolmen who discussed phenomena by talking of "proper" and "improper" motion, and decided questions not by illuminating from the foundation but simply by appealing to academic shibboleths.

That, too, is the meaning of resting my hope, not on "the young" as your critic cautelously insinuates, but on uncontaminated and capable young minds.

ARTHUR LYNCH.

80 Antrim Mansions, Haverstock Hill, N.W.,
October 30.

COL. LYNCH'S complaint of ill-usage to his book in the review in NATURE amounts to a charge that the reviewer has failed to appreciate the originality and the scientific importance of the author's system of psychology. This charge is true. All I can do is to assure your readers that I wrote without consciousness of prejudice, and only after a thoughtful reading of the book and sincere attempt to discover the author's meaning. I respect the author and had no intention of giving offence.

I am surprised and sorry that my reference to the author's former book is resented. May I say that the playful, not spiteful, allusion to the reception of the greatest philosophical book of the greatest British philosopher, Hume's "Treatise of Human Nature," was not meant to bear any reference to financial matters. Col. Lynch says that the whole edition of his former book has, in fact, been sold. I am glad, but I had no thought about it. Possibly Col. Lynch does not know that the whole edition of Hume's book was sold and that he was not smarting under financial loss when he said that it had "fallen still-born from the press."

THE REVIEWER.

Psycho-Analysis and Anthropology.

DR. MALINOWSKI'S illuminating letter in NATURE of November 3 contains a reference to what he rightly calls my "harsh judgment" upon Freud's incursion into ethnology. But he has not made it clear that I was criticising the views expressed in "Totem and Taboo" and not Freud's teaching as a whole. For I am in complete agreement with the latter part of Dr. Malinowski's letter, in which he insists upon the value of Freud's reform in psychological method for the solution of anthropological problems.

The examples quoted by Dr. Malinowski himself illustrate the aspect of Freud's work which is not merely fallacious but also in conflict with the essential part of his own teaching. Moreover, Freud entered the ethnological arena without preparing himself for the fray by making himself acquainted with the facts he attempts to explain. No one with any knowledge of the practices of totemism, exogamy, and taboo, can fail to recognise that Freud is unacquainted with the essential facts and associations of these remarkable customs, and that his suggestions as to their origin are irrelevant and nonsensical.

The essence of Freud's reform in psychological method was his insistence upon the fact that all the vagaries of behaviour and belief, the phantasies of the sleeping and waking life, had definite causes, which could be discovered and traced back to their real source in the individual experience of each of his subjects. But after exploiting this method of analysis of individual experience up to a certain point, Freud suddenly changes his tactics and quite inconsequently postulates a "universal symbolism," into conformity with which he tries to force the incidents of each individual's distinctive experience. This appears to me to be in direct conflict with the essential feature of his theory and practice. Moreover, this speculation of "universal symbolism" is responsible for most of the unsavouriness of Freud's methods which have excited such violent antagonism, and I believe not without some measure of justification. It is the duty of those who appreciate the value of the really fundamental part of Freud's reform to expose the inconsistency of these accretions which imperil the whole doctrine.

The criticism of his adventure into ethnology is inspired not only by the realisation of his lack of knowledge of the subject, but also by the fact that it is the more than doubtful and inconsistent part of his psychological teaching which he proposes to use as a panacea for the cure of ethnological difficulties. At a time when the ethnological doctrine of "psychic unity" is at its last gasp, Freud comes along with the fantastic nostrum of "typical symbols" and tries to revive it.

In the *Monist* of last January, I have analysed the claims made by Freud in "Totem and Taboo," and exposed their futility. But as even the qualified support Dr. Malinowski accords to this aspect of psycho-analytic method involves a very grave danger to anthropology, I have repeated here some of the arguments set forth in greater detail in that criticism.

G. ELLIOT SMITH.

The Origin of Petroleum.

I HAVE read, with much interest, the article on the "Origin of Petroleum" in NATURE of October 27, p. 627.

In a discussion of this nature one of the great difficulties, as mentioned by Mr. Cunningham-Craig, is for geologists and chemists to meet on common ground. This applies, for example, to a point raised in the article in NATURE as well as during the discussion at the Institution of Petroleum Technologists, in the words to "formulate any one hypothesis to explain the formation of such complex mixtures as mineral oils, and still more difficult to account for the great diversity in chemical composition exhibited by mineral oils from different localities." Considering coals as analogous, are not the chemical and physical variations between lignite and anthracite fully as great as those found throughout the range of petroleums? Yet no one casts doubt on the vegetable origin of coal on the score of the almost infinite variety of coal.

In the case of petroleum, formed from the same raw material, in itself extremely variable, other subsequent variables enter; one is the extreme delicacy and susceptibility of both the forming and formed petroleum to ever-continuous changes of temperature and pressure within the earth's crust; and the other is that petroleum can in general definitely be proved to have migrated at least several thousand feet, and during this process it may undergo chemical alteration, especially during contact with catalysers. In forming oil in the laboratory the principal variables at the disposal of the chemist are temperature, pressure, and catalysers; by varying these he obtains widely differing products from the same organic matter. In Nature, with infinite time added to the list of variables at present known, we seem to me to be not only fully justified but utterly unable to avoid expecting an almost infinite variety of petroleums.

I believe it has now been recognised that cholesterol and phytosterol are not necessarily any criterion as to animal or vegetable origin, since both can be made from a number of raw materials.

It is difficult to limit remarks on a subject so wide and important, but in conclusion I should like to make one further comment. Petroleum in the making at surface has been mentioned in various parts of the world, but these reports are frequently due to faulty observation or untenable hypotheses, and Djebel Zeit, Egypt, is no exception. I think all geologists are agreed that the oil there is, at latest, Miocene, and most probably of Cretaceous age, and that its presence in the corals is due to submarine and shore seepages, some of the oil from which lodged in the porous corals, and that on the local evidence it cannot possibly be explained by formation *in situ*.

G. W. HALSE.

Abbey Buildings, 8 Princes Street,
Westminster, S.W.1, November 2.

The Ralline Genus Notornis, Owen.

THE ralline genus Notornis was established by Sir Richard Owen in 1843 upon a series of bones sent him from New Zealand by the late Mr. Walter Mantell, in one of the earlier consignments of Moa bones discovered in the sand-dunes where the Maoris feasted. Owen designated his type species *Notornis Mantelli*. In the course of determining a collection of ornithological remains from turbaries, caves and kitchen middens from New Zealand and the Chatham Islands, containing many relics of those birds, I was bewildered, a few days ago, by discovering that this long-established genus had been boldly superseded by Messrs. Mathews and Iredale in their beautiful work on the "Birds of Australia," by the new generic designation, Mantellornis—one of the numerous topsy-turvies their volumes contain.

In 1843 Notornis was supposed to be an entirely extinct rail. After the lapse of many decades, however, more than one specimen has been obtained in the flesh, an example of which, known to zoology for some thirty years as *Notornis hochstetteri* of Meyer, is now preserved in the Dresden Museum. This specimen was dissected by that distinguished biologist, the late Prof. Jeffery Parker, who found it, in its osteological details, so closely affine to *N. Mantelli* as to cause him (as he told me) much doubt as to its differing in any character from Owen's species. The authors above cited have now renamed the Dresden specimen *Mantellornis hochstetteri* for the sole reason that Owen's genus was founded on *fossil* bones—after all not really fossil. It must now be equally legitimate for the next daring Neozealandian systematist to follow this example and assign a new genus, say Iredalornis, to the Apteryx bones occurring in New Zealand pleistocene and more recent deposits, and in caves and cooking-ovens, the minutest anatomical details of which agree with those of the Kiwis living within sight of the scenes in which their very own parents perished—a violent breach of the Rules of Nomenclature not less unscientific than the substitution of Mantellornis for Notornis.

It seems to be coming to this, if we are to be guided by these extremist authorities on nomenclature, that the very same creature is to be assigned to one genus when it is studied from the inside, and to another when (found alive) it is studied from the outside. Against such absurd genus-making—than which no more glaring example has surely been perpetrated in any reputable zoological publication—I, for one, desire to enter my strongest protest, in the interests of biological science, and against the confusion that must inevitably result if such procedure, as is described in this letter, is to be followed.

HENRY O. FORBES.

Redcliffe, Beaconsfield, Bucks,
October 28.

Dr. Jesse W. Lazear and Yellow Fever.

THE story of the death of Lazear as commonly told is that mentioned in NATURE of October 27, p. 631, namely, that he "allowed himself to be bitten by mosquitoes that had fed on the blood of yellow fever patients." It may, however, be worth while to state that the mosquito-bite which killed him was inflicted, not experimentally, but by a "wild mosquito" in the ward in which he was working (September 1900). This was told to me in Panama in 1904 by Dr. T. C. Lyster, who was actually with Lazear when the insect bit him on the hand; and Lazear then remarked, "I wonder whether this creature is infected"—or words to that effect. It was Dr. J. Carroll, who had been previously, and experimentally, infected by mosquitoes fed on yellow-fever patients; but he recovered. Nevertheless, Lazear's case was almost as good as an experimental one. The whole heroic story will be found set forth in Dr. Howard A. Kelly's "Walter Reed and Yellow Fever" (The Norman, Remington Company, Baltimore), and is given briefly in my Memoirs, p. 425.

RONALD ROSS.

Life History of the Ephemeridæ.

I HAVE been asked by a French observer, M. A. Gros of Marigny (Jura), France, if I can put him into touch with entomologists interested in the Ephemeridæ. M. Gros is the author of an illustrated brochure, "Études sur les premiers études des éphémères du Jura français," which deals mainly with *Ecdyonurus forcipula* of Central Europe—not, I believe, found in the rivers of the British Isles. M. Gros would prefer to correspond in French if possible. He appears to have established some interesting facts, which may help us in our endeavours to transplant water-flies from one river to another. So many causes are denuding our rivers of their natural supplies of Ephemeridæ, etc., that it is most important to introduce fly from other waters if possible. It has been done, at least temporarily, in a few instances.

R. B. MARSTON,
Editor, *Fishing Gazette*.

19 Adam Street, Strand,
London, W.C.2,
October 29.

Natural History in Kinematography.

THE value of the kinematograph as a means of obtaining permanent graphic records of phases of animal movement, and of the various stages of growth and change of form that go to make up the story of the life-history of insects and other invertebrates, is, at long last, becoming more generally appreciated; while to find a British firm devoting its energies entirely to the production of such films is an encouraging sign of the growth of public interest in the pictured story of animal life. The British Instructional Films Ltd., the firm in question, has started the issue of a series of remarkably interesting natural-history films under the general title of "Secrets of Nature," which we are glad to hear will be shown as part of the regular programme at kinematograph theatres in London and the provinces. This is a step in the right direction, and should help further to demonstrate the importance of the kinematograph as a means of popular instruction.

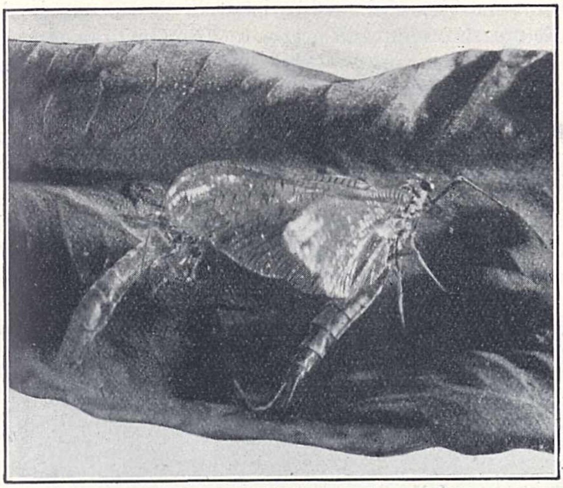

FIG. 1.—Imago of mayfly just emerged from sub-imago stage, showing cast skin, which is waterproof to enable it to escape from water.

The subjects included in the series cover a fairly wide range, and should appeal not only to all who are interested in bird and insect life, but also to the lover of the open countryside and the wild life of field and hedgerow, to the antiquary, and to the angler. There is a wonderfully complete film of the life-history of the Mayfly that must have cost an infinite amount of patience and care to obtain; a reproduction of one of the pictures is given in Fig. 1. This is appropriately followed by a still more striking record of spring salmon-fishing in Scotland amidst the most picturesque surroundings (Fig. 2). In the latter film, use was made of the ultra-rapid kinematograph camera to obtain for the first time a complete record of fresh-run salmon ascending the waterfalls and rapids in their journey up stream to their spawning grounds. By means of the ultra-rapid camera it is possible to take records at as much as eight to ten times the normal speed, so that, given sufficient light for the extremely short exposures entailed, a film may be obtained of every phase of the swift rush and leap of the fish; movements too rapid for the eye to follow or appreciate. These ultra-rapid records are projected on to the screen at the normal rate at which kinematograph films are shown, namely, at sixteen pictures a second, which enables the observer to follow clearly every detail of movement; and the lightning-like dart and leap of the fish passes across the screen as a slow and amazingly graceful series of movements.

Watching these perfect pictures, one cannot help thinking of those early pioneers of chronological photography, Marey and Muybridge, and of how much they would have given to have had at their disposal such apparatus for taking their records of trotting horses and running men. There can be no doubt that this latest development of the kinematograph will prove of invaluable service in the critical analysis of movement. During the past summer there have been taken in the Zoological Society's Gardens at Regent's Park several extremely interesting records with this apparatus, including the movement of the long tongue of the chamæleon, the forked tongue of a python, and the Barbary sheep descending the almost vertical sides of the high rocks in their enclosure in the Mappin Terraces.

Another subject included in the series will undoubtedly arouse considerable interest, for it has an historical as well as a biological aspect: that is the film record of the story of Westminster Hall and its wonderful roof. This film was taken under the direction of Sir Frank Baines, and shows not only the work of restoration in progress, but also the actual cause of the threatened danger to the venerable roof, the larvæ of the deathwatch beetle at work excavating its galleries in the heart of the old oak beams (Fig. 3). The film of the gallant little three-spined stickleback engrossed in the domestic duties of nest-building (Fig. 4), enticing the female to deposit her eggs therein, and then

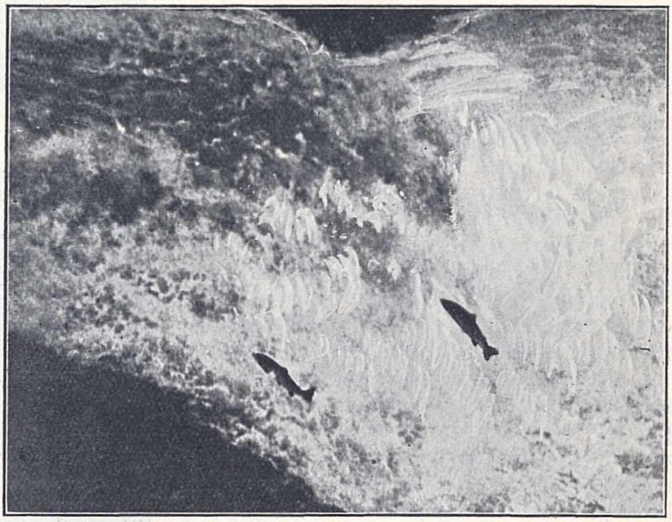

FIG. 2.—Salmon ascending a waterfall on their way to their spawning ground.

mounting guard over the spawn, and later protecting the newly-hatched fry from marauding visitors (Fig. 5),

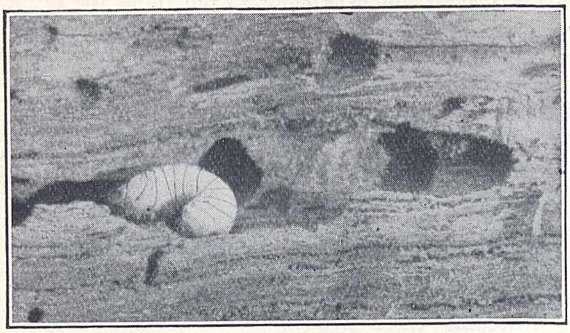

FIG. 3.—Larva of deathwatch beetle eating into roof-timbers of Westminster Hall.

is an ideal nature study subject which is bound to rivet the attention of every boy who has the good fortune to see it. One can but hope that in the near future this class of film may become a regular feature in the programme of the kinematograph theatres throughout the country, and ultimately replace much of the vulgar trash and sordid themes that at present occupy far too prominent a place on the bill.

The production of these natural-history films is by no means a simple matter, for if they are to be of real educational value, not only must the record show the subject clearly, but also they should be taken by, or under the direct supervision of, one who is thoroughly conversant with the habits, characteristic movements, and life-history of the creature, so that no important phase is missed or wrongly interpreted. This the British Instructional Film Company appears fully to have realised, their films having been taken and edited by a band of acknowledged experts. The actual taking of these records of animal life calls for great technical skill and judgment and for the exercise of untiring patience, for the difficulties to be surmounted are infinitely greater than in ordinary photography. Hours of patient watching and waiting have to be faced, and often when the end seems in sight something will happen; the stock of film in the camera runs out, or the sky becomes too overcast to permit of sufficient light for the extremely short exposures necessary, and the final stage is missed—perhaps the last possible chance of the season, and the whole of the work has to be begun all over again the following year. " Light, more light ! " is the constant prayer of the naturalist kinematographer, for he must be able to obtain sixteen fully exposed little film negatives per second if his record is to give an approximately truthful screen picture; while to catch every stage in a swift movement like the leap of a salmon or the beat of an insect's wing, the sixteen pictures may have to be quadrupled at least.

Although the photographic emulsion with which the celluloid film is coated is very fast, the need for such extremely short exposures renders it necessary to employ lenses working at very large apertures, at F.2, or F.3, if sufficient light is to reach the film. Consequently, the depth of field that will be critically sharp when working close up to the subject, as one has to do when recording the movements of small insects, will be limited practically to a few inches, necessitating constant most careful readjustment of the focus, should the creature approach nearer to the camera or elect to move further away; while owing to the enormous subsequent enlargement of the picture when projected on the screen, every detail must be recorded on the negative film with microscopic sharpness. Last, but by no means least, the subject, if a bird or a mammal, has to be accustomed to the presence, and the sound when in operation, of the kinematograph camera; this often calls for considerable patience, for all wild creatures are suspicious of unfamiliar objects or sounds.

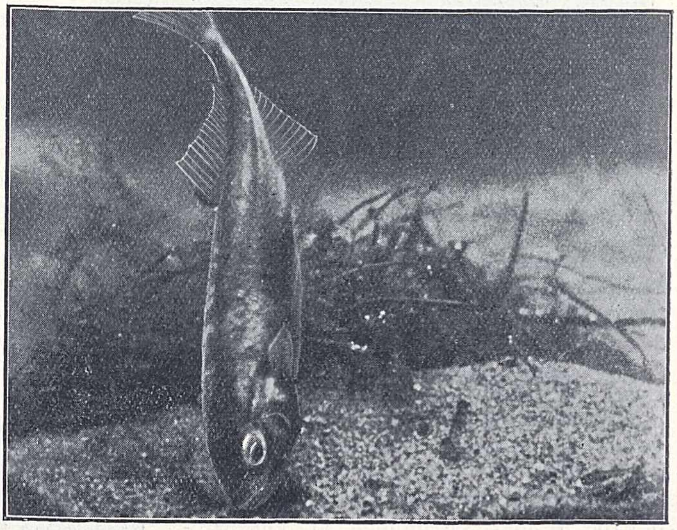

FIG. 4.—Male three-spined stickleback clearing ground preparatory to building nest.

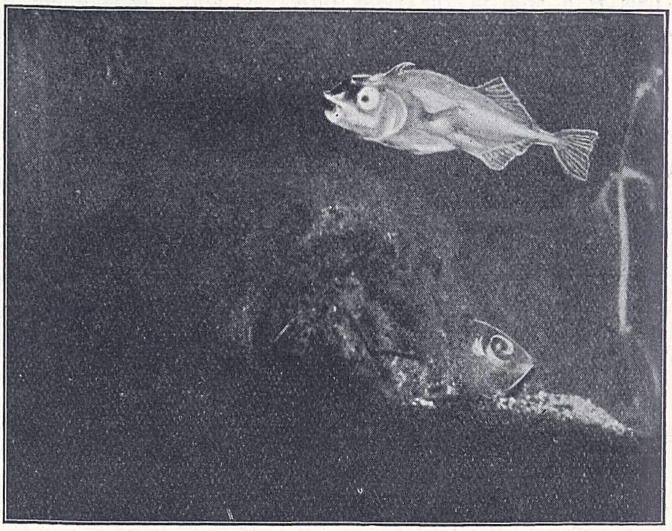

FIG. 5.—Nest completed, and female depositing spawn, while male guards the nest.

Even in captivity, this inborn mistrust and uneasiness in the presence of an unfamiliar sight or sound is maintained, and may result in agitated, unnatural movements, giving a totally false impression of the true natural characteristics of the animal.

This has been demonstrated on several occasions in making records of some of the shyer animals in the collection of the Zoological Society of London. In obtaining successful records of the rare and interesting maned wolf of South America, the kinematograph apparatus had to be set up again and again and the mechanism run without any film, before the animal could be induced to tolerate its presence or move about in a natural manner. On the other hand, the anthropoid apes, like children of the human race, are so intensely curious and interested in what is going on, that they will cease playing about in their normal fashion until they have been permitted thoroughly to examine the apparatus and satiate their curiosity.

We are indebted for the accompanying illustrations to the directors of British Instructional Films Ltd., 26-27 D'Arblay Street, Wardour Street, London, W.1.

Meteorological Perturbations of Sea-Level.

By Dr. A. T. DOODSON.

IT is always understood that the predicted heights of high and low tidal water do not take into account the variations in the height of the sea due to wind and to air-pressure, and that the errors due to these causes may be of considerable magnitude. With the large ships that are now in common use the margin between sea-bottom and ship-bottom is small, and since many of the largest ports in the world are situated in comparatively shallow water, navigation, both in channels and into dock, is carried on only with constant reference to the state of the tide. A particular example of the problem is that of loading a vessel in dock: how much cargo must be left on the quay-side so as to leave sufficient clearance for the vessel to get safely out of dock? The cargo so left has afterwards to be transported by lighter, with consequent increase of expense. If the tide is lower than was expected there is increased risk to the vessel, and if the tide is higher than was expected needless expense has been caused through leaving cargo to be transported by lighter. It is therefore obvious that a forecast of the effects of wind and air-pressure on sea-level and tides would be of very great advantage to navigators in and near a port, and for this reason much attention has recently been given to the subject.

The effects of wind and air-pressure on sea-level are also important factors for engineers engaged in the construction of harbour works. Again, they are of importance in connexion with geodetic surveys, since sea-level is an obvious datum from which to take measurements; but it has been shown by the Ordnance Survey ("Second Geodetic Levelling of England and Wales," p. 34) that measurements by levelling gave mean sea-level at Dunbar and Liverpool respectively 0·8 ft. and 0·4 ft. higher than at Newlyn. These discrepancies cannot be attributed wholly to errors of levelling, and there is reason to believe that part of the explanation is connected with climatic causes. Investigations as to the variation of sea-level with wind and pressure have been made by Mr. H. L. P. Jolly, of the Ordnance Survey, and are referred to below.

Most investigations on this subject have been concerned with air-pressure and not with wind, the sea being regarded as a negative water barometer; the "constant" for the barometer, however, varies much from place to place, and even according to the numerical method used in obtaining it. A British Association Committee in 1896 reported that the effects of wind and pressure were real, but no law could be established; the methods of investigation, however, were faulty. A successful reduction to law for both wind and pressure in connexion with tides at Ymuiden was published by Ortt in 1897, his method being to collect together observations for given ranges of values of pressure, wind direction, and strength. This method has been used, in essence, by other continental workers. Prof. R. Witting (Bulletin de la Société de Géographie de Finlande, Fennia, 39, No. 5, 1918) has elaborated a method of comparing the gradients of the sea-level in the Baltic Sea with the gradients of the pressure-system over the sea; this method is strictly in accordance with theoretical considerations, but it requires a large number of observing stations, and is most confidently applied to narrow seas. His use of pressure gradients instead of wind-strength and direction of wind is very commendable, and was utilised by Mr. Jolly in his investigations, leading to the simple formula

$$\zeta = \kappa(\mathrm{B} - \bar{\mathrm{B}}) + \lambda(\mathrm{E} - \bar{\mathrm{E}}) + \mu(\mathrm{N} - \bar{\mathrm{N}}),$$

where ζ is the meteorological disturbance of sea-level; B, E, N are the values of the local barometric pressure and its gradients to the east and north respectively; bars denote means in the interval of time considered, and κ, λ, μ are constants determined from observation.

This formula is valuable because it lends itself very easily to numerical methods, and fairly accurate values of the constants may be obtained from observations extending over only a month, whereas an elaborate method like Ortt's requires far more observations and much more labour. It represents the perturbations of mean sea-level with a fair degree of accuracy.

The formula has been used extensively at the Tidal Institute at Liverpool, and has yielded some very interesting results. It is easy to deduce from it the direction of the most effective wind for raising sea-level at the place considered, and this has been evaluated from a month's observations at various places on the British coast, the results being illustrated in Fig. 1. The arrows give the direction from which the most effective winds blow, and the lengths of the arrows are proportional to the effects for a given strength of gradient in the most appropriate direction. Many previous investigators dealing with the perturbations of mean sea-level on the Continental coast of the North Sea have found that the most effective winds for raising sea-level there are those which blow towards the shore, and conclusions have been formulated that the effect is due to the local wind blowing the water towards the shore. This conclusion is not substantiated by Fig. 1, for the winds which raise sea-level on the east coast of Britain are those which blow away from the shore. A westerly wind therefore raises the water of the whole of the North Sea in some degree or other, and this effect must therefore be due to wind blowing over a large area to the north of Scotland. The direction of the most effective wind at Felixstowe has a much larger northerly component than is present at Dunbar. In other words, a northerly wind would have little effect at Dunbar as compared with Felixstowe, the reason probably being that the sea becomes shallower towards the south, agreeing with theoretical conclusions that, apart from the effects of rotation, wind operates more effectively in shallow water than in deep water.

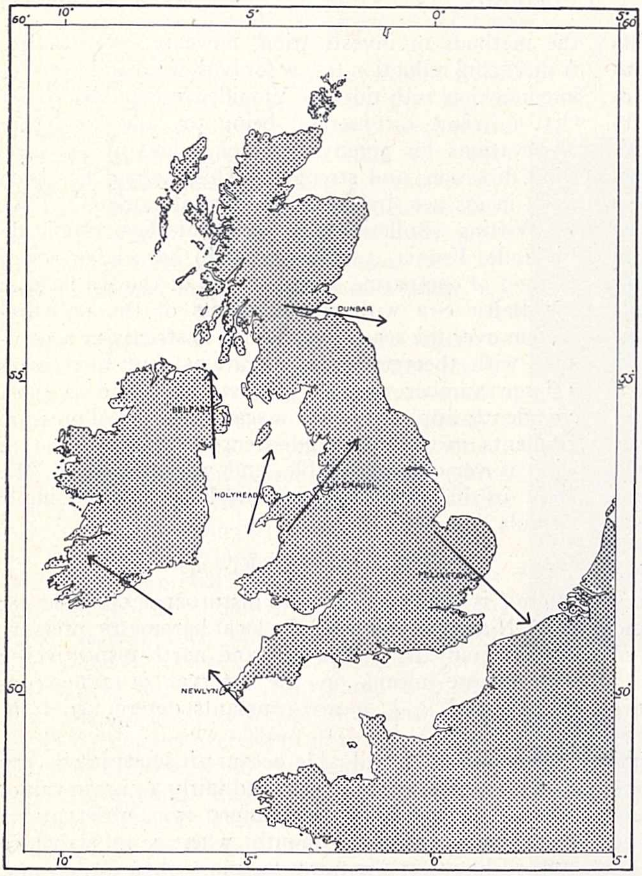

FIG. 1.—The most effective winds for raising sea-level round the British Isles.

The Irish Sea gives some interesting results. It would appear that from Newlyn northwards the most effective wind has a large southerly component. Local influences are far more marked at Newlyn and Cork than at Holyhead and Belfast, while the effect of the broadening out of the Irish Sea is shown slightly at Holyhead and still more at Liverpool, where the westerly component of the wind shows its influence, and again the shallower water of the upper part of the Irish Sea helps the effect.

Some of these conclusions could have been formulated roughly from qualitative statements in seamen's almanacs, but what gives value to the results dealt with above is that they are expressed quantitatively. Further, qualitative statements are liable to give not the most effective wind for a given wind-strength, but that wind which has happened to give a storm-effect.

The predominating factor in the above results is the southerly wind operating on the Atlantic water south of Ireland. This conclusion has been verified for Liverpool by applying an extension of the formula so as to include Atlantic winds (south of Ireland) as well as local winds. The results show that, for a given wind-strength operating in the most favourable direction in each case, the Atlantic wind has 50 per cent. more effect than a local wind, in spite of the deeper Atlantic water being less favourable to wind effects. Further, the most effective Atlantic wind blows from the south and the most effective local wind from almost due west.

When we correlate the pressure system at a fixed time with the mean sea-level at a variable time we find that the correlation between the sea-level at Liverpool and an easterly gradient of pressure, corresponding roughly to a south wind, is greatest when the mean sea-level is taken about fifteen hours later than the corresponding pressure gradient. The corresponding time for Newlyn is nine hours. For a northerly gradient, however, the time difference for maximum correlation with mean level at Liverpool is practically zero. These results are in conformity with those just discussed, for we should expect a large time-interval for setting up the circulation of water from the Atlantic and a small time interval for effects generated in the Irish Sea.

It can be deduced, therefore, that the most favourable conditions for giving exceptional effects on sea-level are those in which a south wind blows for some hours, filling the Irish Sea as a whole, and then changes to the west—the rapidity with which the west wind operates is apparently favourable to storm-effects.

The correlation between mean level at Liverpool and the fluctuation of the local atmospheric pressure is greatest when the sea-level is taken about three hours earlier than the pressure. For Newlyn the time-advance is five hours. These results are of very great interest: the anticipation in mean sea-level of changes in barometric pressure is probably due to the different rates of travel of disturbances through air and through water. Ferrel (U.S. Coast Survey, Report, 1871, p. 93) in 1871 noted that the changes in sea-level in Boston Harbour, U.S.A., appeared to anticipate the barometric pressure. Anticipation of coming storms, according to Dr. Bell Dawson (Trans. Roy. Soc., Canada, 1909, pp. 186-188), is also shown in the currents off Newfoundland; a change in magnitude and direction is noticeable some twelve hours before the onset of a storm, and generally (with some exceptions) the current sets more strongly towards the direction from which the wind is about to blow. This phenomenon is regarded by the local fishermen as an unfailing indication of bad weather. These anticipatory effects are worthy of fuller investigations.

Current Topics and Events.

THE Royal Swedish Academy of Sciences, Stockholm, has awarded the Nobel prize for physics for 1923 to Dr. R. A. Millikan, director of the Norman Bridge Laboratory of Physics at the California Institute of Technology, Pasadena, and the Nobel prize for chemistry for 1923 to Prof. F. Pregl, professor of applied medical chemistry in the medical faculty of the Karl Franzens University, Graz, Austria. Dr. Millikan is best known for his work on the determination of the absolute value of the charge of the electron. Before his experiments various measures had been made of this, by condensing a cloud on free electrons in a gas and observing how the cloud behaved. Millikan found that it was possible to watch the single drops, and thus discovered many inaccuracies to which the earlier work was subject, and this enabled him to modify it into a method of precision. In his final arrangement, a small drop of oil or mercury was watched in a microscope as it slowly fell under gravity or, acquiring a charge, rose in an electric field. In this way he could observe directly the atomic nature of electricity; for if the speed of the drop ever changed it would always change by a discrete amount In the course of these experiments he worked out the problem of the motion of a sphere in a viscous fluid, and found under what conditions Stokes's law is verified; more recently he has made his work throw light on the nature of the collision of a gas molecule with a solid or liquid surface. It is a fairly safe prediction that it will be long before methods are devised which will give more accurate values than Millikan's for the electronic charge and the associated constants. Only second in importance is his very accurate determination of the quantum by means of the photoelectric effect. His work not only completely verified the Einstein theory, but also showed that the " limiting potential " of that theory is identical with the ordinary contact potential. Since then Dr. Millikan has added a great deal to our knowledge of the spectrum in the region of very short waves.

THE London School of Tropical Medicine, cooperating with the New Zealand Government, has just sent an expedition to Samoa to study the depopulation of the Pacific from the medical point of view. The expedition is led by Dr. Patrick Buxton, and will probably be in Samoa about two years. It is proposed to select a small island and try to exterminate *Aedes variegatus* (*pseudo sentellaris*), the particular mosquito which carries filariasis: a majority of the natives are infected with this disease. This large-scale experiment should afford information about costs and methods, and will be of value in many parts of the world. An investigation of all biting insects will be made, and the party is equipped to study the problems of ventilation and temperature in various types of house. An effort will be made to collect insects in general, even those of no economic importance, because it is presumed that a peculiar fauna still exists in the virgin forests which cover the centres of the islands, and that this fauna is in danger of being exterminated by enemies introduced from other islands.

WITH the December issue the monthly publication of the meteorological ocean charts ceases. The information supplied on the back of these charts will in future appear in a monthly magazine entitled the *Marine Observer* which will be on sale by the Stationery Office. The magazine will be supplied free to the commanders of all ships on the list of regular observers to the Meteorological Office. The face of the charts for each month of the year, with information which is of a permanent nature, have been printed in limited numbers, and one set will, we understand, be supplied, according to its trade, to each ship on the list of regular observers, on request being made by the commander. These charts of frequencies and normals of the North Atlantic or East Indian Seas for each month of the year may be purchased at one shilling each from the Admiralty chart agents. The December issue of the East Indian chart contains a useful index to the information published on the back of the charts from 1906 onwards.

THE many friends of Sir Arthur Schuster will learn with much regret that a few days ago he met with an accident which may lead to the loss of sight of one of his eyes. It appears that he was accidentally struck by a golf-club while standing near a lady player, the result being that his glasses were broken and a piece of glass entered one of his eyes.

THE selection committee of the Harrison Memorial prize, which, in accordance with the trust deed, consists of the presidents of the Chemical Society, the Institute of Chemistry, the Society of Chemical Industry, and the Pharmaceutical Society, will meet shortly to consider the first award of the Harrison Memorial prize. The prize, of the value of about 150*l.*, is to be awarded to the chemist of either sex, being a natural born British subject and not at the time over thirty years of age, who, in the opinion of the selection committee, during the previous five years has conducted the most meritorious and promising original investigations in any branch of pure or applied chemistry and published the results of those investigations in a scientific periodical or periodicals. Provided that in the opinion of the selection committee there is a candidate of sufficient distinction to warrant an award of the prize, the first award is to be made in December next. The selection committee is prepared to receive applications, nominations, or information as to candidates eligible for the prize, which must be addressed to the president of the Chemical Society, and should reach Burlington House, Piccadilly, London, W.1, before December 10.

ON November 14, Prof. R. A. Peters delivered his inaugural lecture as Whitley professor of biochemistry in the University of Oxford. Speaking of the interchange of teachers between Oxford and Cambridge, which he thought was to the advantage of both Universities, he directed attention to the fact that Oxford had inclined to the synthetic and Cambridge to the analytic aspect of biochemistry. The " steamengine" view of the body has been proved inadequate; nutrition cannot be expressed in terms of calories. The proteins of food enter the blood as amino-acids; the body forms its own proteins. The connexion between "miners' cramp" and the loss of salts is well established, and gives promise of further light on other morbid conditions. Increased cleanliness in food has tended to cause a deficiency in vitamins. Bread and rice have both suffered in this respect, but under civilised conditions the deficiency can be made up in other ways. A new importance to physiological chemistry is given by the discovery of the functional activity of endocrines. A large audience, including the Vice-Chancellor, was present at the lecture.

WE learn from the *Belfast Evening Telegraph* of October 24 that a new Naturalists' Field Club, styled the "Route," has been founded for northern Antrim, and that it is affiliated to the Belfast Club. The latter now numbers 703 members, and has been described by those who derive much mental profit from its various meetings and excursions as a second university for Belfast. It has the advantage of retaining as advisers members who have watched and fostered its progress for more than fifty years.

IT is announced in *Science* that Mr. John D. Rockefeller, Jr., has given 100,000*l*. toward the endowment fund of 400,000*l*. required by the New York Zoological Society, and will contribute a further 100,000*l*. as soon as the society raises another 200,000*l*. Mr. Edward S. Harkness has given 20,000*l*. and the estate of Mrs. Frederic Ferris Thompson 10,000*l*. For some time the Society has been carrying educational, philanthropic, and civic burdens far beyond its financial resources. Mr. Rockefeller's gift is without restrictions and the income becomes immediately available.

NOTIFICATION is given by the Chemical Society that applications for grants from the society's research fund (made upon forms obtainable from the Assistant Secretary, Burlington House, W.1) must be received on or before Saturday, December 1. The income arising from the donation of the Goldsmiths' Company is to be more or less especially devoted to the encouragement of research in inorganic and metallurgical chemistry; the income from the Perkin memorial fund is to be applied to investigations relating to problems connected with the coal-tar and allied industries.

THE following officers have been elected by the London Mathematical Society for the session 1923–1924:—*President*: Prof. W. H. Young; *Vice-Presidents*: Prof. L. N. G. Filon, Prof. H. Hilton, and Prof. A. E. Jolliffe; *Treasurer*: Dr. A. E. Western; *Secretaries*: Prof. G. H. Hardy and Prof. G. N. Watson; *Other Members of the Council*: Mr. J. E. Campbell, Prof. A. L. Dixon, Miss H. P. Hudson, Prof. G. B. Jeffery, Prof. A. E. H. Love, Mr. E. A. Milne, Mr. L. J. Mordell, Mr. F. B. Pidduck, and Mr. F. P. White.

VISCOUNT LONG OF WRAXALL has accepted the presidency of the forthcoming Empire Mining and Metallurgical Congress to be held at the British Empire Exhibition on June 3-6, 1924, of which the Prince of Wales is honorary president. The following have accepted invitations to become honorary vice-presidents of the Congress: The Secretary of State for the Colonies; the Secretary of State for India; The Secretary for Mines; the Prime Ministers of Canada, Australia, New Zealand, and Newfoundland; the High Commissioners of the Dominions and British India; and the Lord Mayor of London. The presidents of the seven convening bodies (*v*. NATURE, September 22, p. 453) will act as vice-presidents and will preside over the sections with which they are concerned.

THE issues of the Journal of the Royal Society of Arts for October 5, 12, and 19 contain the three Cantor Lectures by Mr. J. E. Sears on precise length measurements. To those who have not access to the various publications of the National Physical Laboratory, these lectures provide up-to-date information on the methods in use there for maintaining the ultimate standards of length and for accurately comparing the secondary standards in use in industry with the ultimate standards. The instruments used are almost all unique, and the accuracy attained with them one-millionth of an inch. We are glad to note that, as the result of work done by one of the staff of the Laboratory, it is likely that gauges of the accuracy of the Johansson gauges from Sweden will be made on a commercial scale in Great Britain.

ON Thursday and Friday, November 8 and 9, the sixth joint meeting of the Challenger Society and representatives of Marine Biological Stations was held at Cambridge under the chairmanship of Prof. J. Stanley Gardiner. The meeting was attended by more than fifty representatives of various organisations. Papers were read by Messrs. J. Barcroft, G. Bidder, F. F. Blackman, H. G. Carter, H. M. Fox, J. Gray, W. B. Hardy, H. G. Hopkins, T. Moran, J. Piqué, F. A. Potts, J. T. Saunders, and J. M. Wordie. Special attention was paid to the problems of cold storage. These meetings, which were inaugurated and are assisted by the Development Commission, are held periodically at the various marine laboratories and elsewhere.

THE opening meeting of the Illuminating Engineering Society on November 13 was, as usual, devoted to reports of progress and exhibits illustrating developments in lighting. Mr. Gaster, reviewing progress during the vacation, alluded to the appointment of a Committee on Illumination by the Department of Scientific and Industrial Research, and mentioned that the next technical session of the International Illumination Commission is to be held in Geneva in July next year. A conference dealing, among other matters, with industrial lighting, is being arranged by the International Labour Bureau of the League of Nations in Geneva in the same month. Reference was made to the newly-formed Association of Public Lighting Engineers as an illustration of the growing interest in illumination and the need of bringing the aims of the Society before a wider circle of the public.

This point was again emphasised in the report presented by the Committee on Progress in Lamps and Lighting Appliances, which described efforts being made to effect standardisation of lamps and fittings. Amongst other recent steps ten standard types of lamps suitable for automobile headlights, meeting the requirements of practically all British cars, have been evolved. Mr. L. E. Buckell showed some of the very large gas-filled electric lamps consuming 3000-4000 watts and other types with filaments specially designed for projector work. A new feature was the process for spraying bulbs with finely divided china clay; this gives a soft light and good diffusion, with an absorption estimated not to exceed 7 per cent. The sprayed surface is said to have good wearing properties, and it is believed that these lamps will prove useful in cases where they are unavoidably exposed to view in the direct range of vision and yet it is desirable to avoid glare. Miss Beatrice Irwin gave a demonstration of the colour filter system associated with her name, a variety of lighting units consisting of cylinders of hand-painted parchment paper in pleasing combinations of colours being shown.

Leaflet R. 58 received from Messrs. Newton and Wright, Ltd., 471-3 Hornsey Road, N.19, describes the "Harley" unit for dental radiology. The chief feature of the apparatus is in the movements of the X-ray tube, which is a very important feature in practice. Flexibility is here combined usefully with rigidity, and arrangements are made which allow of stereoscopic radiographs being taken. The high-tension transformer is oil-immersed, and when in action one pole is earthed; a separate transformer with the necessary adjustments for the control of the filament current of the Coolidge tube is supplied. In order to vary the penetration of the X-rays, four alternative voltages may be applied to the tube terminals. This appears to be an ample margin for the requirements of dental radiology.

Messrs. C. F. Casella and Co., Ltd., 49 and 50 Parliament Street, London, S.W.1, have issued a new catalogue, No. 523, which contains particulars and illustrations of a very wide range of surveying and drawing instruments and appliances. Detailed specifications are given of the more important instruments manufactured by the firm. In the design of several of these, many improvements are embodied, which either give some additional facility to the user or increase the accuracy or length of life of the instrument. A notable addition to the list is the new double-reading micrometer theodolite, which has been designed for geodetic and exploration purposes where accuracy of the highest order is desired. In this instrument the diametrical points of the circle are brought together in one field by an optical arrangement. It is therefore possible to set the telescope on the object, take the readings of the bubbles and all four readings of the circle without moving from the front of the instrument. The length of time spent in taking a set of readings is thus considerably reduced. This improvement is accompanied by a reduction in the number of parts employed, and the possibility of the instrument being put out of adjustment is thereby diminished.

Our Astronomical Column.

Reinmuth's Comet, 1923b.—The following two observations, both made at Königstuhl, are now to hand, the positions being referred to 1923·0:

	G.M.T.	R.A.	N. Decl.
Oct.	31^d 9^h 22·1^m	1^h 15^m 11·36^s	22° 26′ 36·0″
Nov.	5 8 15·1	1 17 50·90	19 47 23·2

Mr. Waterfield states, as the result of an unsuccessful visual search, that the object is certainly fainter than the 11th magnitude. This faintness is probably the reason of the delay in obtaining a third observation.

The November Leonids.—Mr. W. F. Denning writes: "Very stormy, unsettled weather prevailed during the most of the period when the return of the November meteors was expected, and it was not possible to watch for the shower on several consecutive nights. Mr. I. P. M. Prentice, of Stowmarket, endeavoured to obtain an early observation of the shower on November 10. For that purpose he carried out a long watch of the heavens commencing at 5.55 G.M.T. and ending at 17.55 G.M.T. He recorded 82 meteors though the sky was partly cloudy at times. Six of the meteors seen were Leonids with a radiant point apparently at 145°+22°. If this position for the radiant is confirmed it will indicate that the Leonid radiant, similarly to that of the great Perseid shower of August, is a movable position which advances about 1° per day. On November 11, Mr. Prentice saw 35 meteors, but the sky became cloudy before 14.50 G.M.T. and watching had to be discontinued. At 12.38 G.M.T. he saw a bright fireball directed from a shower of Taurids. It would be interesting to get another observation of this if other observers happened to be looking for Leonids on the night of November 11 at about 12.38 G.M.T."

The Extrafocal Method of studying Magnitudes.—The advantages of this method are the practical equalisation of the size of disc for different magnitudes and elimination of the effect of peculiarities of images arising from defects in the objective. The quantity measured is simply the density of the image. Mr. Edward S. King (Proc. Nat. Acad. Sciences, U.S.A., Oct. 1923) communicates the results for 100 bright stars from Harvard observations. A yellow screen and isochromatic plates were used, thus giving photovisual magnitudes. The mean excess of the resulting magnitudes over the photometric ones is as follows: B −0·02, A0 0·00, F −0·10, G −0·15, K −0·16, M −0·20. The following colour-indices were deduced: B0 −0·23, A0 −0·02, F0 +0·25, G0 +0·88, K0 +1·28, M +1·87. These are independent of visual observations.

A rediscussion of the observations of Nova Aquilæ, 1918, when near its maximum brilliance, gives colour-index −0·19, instead of −0·35, published earlier. Mr. King also measured the colour-indices of the planets by the same method. The values are: Venus +0·91, Mars +1·45, Jupiter +0·96, Saturn (without rings) +1·22, Uranus 0·74. These accord well with the ruddy colour of Mars and the "sea-green" of Uranus.

The paper also contains new formulæ for the effect of phase-angle on the magnitudes.

Research Items.

MYCENÆAN ELEMENTS IN THE NORTH ÆGEAN.—Mr. Stanley Casson has contributed to the November number of *Man* an interesting analysis of the traces of intrusive Mycenæan culture in Macedonia and Thrace. Mycenæan pottery is derived from nine mounds in the Thermaic Gulf, mostly in the neighbourhood of Salonika, and all but three on the seashore. All this Mycenæan ware belongs, with one exception, to the close of the third Late Minoan period. Mr. Casson's conclusion is that probably Mycenæan imports were purely local and were derived by trade along the sea route from the south to the Thermaic Gulf. He figures two rapiers from Grevena on the upper waters of the Haliacmon and one from Karaglari in the Central Bulgarian Plain which belong to the type of Mycenæan rapier common in the last two Minoan periods. The former appears to have passed up the Vardar Valley or by way of Thessaly; the latter along the Struma. East of the Struma no traces of Mycenæan culture are recorded along the European shore, and Mycenæan traders appear to have had no port of call between Salonika and Troy.

CLIMATE AND THE NASAL INDEX.—At the International Medical Congress held in London in 1913, Prof. Arthur Thomson read a preliminary communication on "The Correlation of Isotherms with Variations in the Nasal Index," in which it was suggested as a result of a survey of the nasal indices of the inhabitants of America that the greatest nose-width was to be found near the "heat-equator," and that a narrowing was to be found in passing north and south to Baffin's Bay and Tierra del Fuego. A joint paper by Prof. Thomson and Mr. L. H. Dudley Buxton which appears in vol. liii., pt. i. of the Journal of the Royal Anthropological Institute, gives the results of an extended investigation on these lines, from which it would appear that in fact a platyrrhine nasal index is associated with a hot moist climate and a leptorrhine nasal index with a cold dry climate; the intermediate conditions being associated with hot dry and cold moist climates. Both on the living (males) and on crania there is a positive correlation between nasal index and temperature. The same applies to nasal index and relative humidity in the living, but in crania the correlation is small. The result of the application of this line of investigation to prehistoric skulls is interesting. The platyrrhine character of the Grimaldi skulls would assign them to a warm Mousterian period; but the skull from La Chapelle aux Saints, being platyrrhine, should belong to a warm period, whereas it is usually assigned to a cold Mousterian period.

FREUDIAN PSYCHOLOGY AND EVOLUTION THEORY.—In the Transactions of the Croydon Natural History Society (vol. ix. pt. 3) there is an interesting article by Mr. C. C. Fagg on the "Significance of the Freudian Psychology for the Evolution Theory." The article consists of three parts. In the first the author outlines the discoveries of Freud, in the second he sketches the salient features of the evolution theory, and in the third he attempts to interpret the second in the light of the first. The paper is interesting as an indication of a scientific attitude of mind towards the Freudian theory. That theory has suffered almost equally from the uncritical assimilation of all its tenets by enthusiastic supporters and from the still more uncritical attacks of those who found its doctrines unpalatable. Mr. Fagg relates certain aspects of it to phenomena well known in the biological sciences. He interprets the stalk of the fixed infusorian as of the nature of a neurotic symptom; some amœboid forms reacted to fear, as in the case of the foraminifera, by putting on a coat of armour made of carbonate of lime or silica, a compromise formation which put a limit to their evolutionary possibilities; only those amœboid forms which retained their mobility and plasticity in the face of danger were able to bridge the gulf to metazoic life. He holds that there are many instances from palæontology to show how, in reacting to fear of environmental dangers, races have sold their souls, so to speak, for some measure of security. He believes that a consideration of some of the findings of Freud would do much to help in the aggravated question of the inheritance of acquired characters. He hopes that by an extension of our knowledge along the lines indicated by psycho-analysis we may some day be able to make a world fit for children to live in, a family and social environment in which super-babies may develop into super-men.

CATTLE FEEDING.—The idea which appears to have suggested the investigation recorded in "Under-Nutrition in Steers," by F. G. Benedict and E. G. Ritzman (Carnegie Institution of Washington), is that it might be economically advantageous to underfeed cattle during the winter, when feeding stuffs are scarce and dear, if it could be demonstrated that a prolonged period of semi-starvation did not inflict on the animals any permanent disturbance of their internal economy such as would hinder their fattening in the succeeding summer. For the purpose of the investigation 14 steers in all were intensively studied, 12 of them during the year November 1918 to November 1919, and 2 during the succeeding year. For the first fortnight the ration aimed at bare maintenance, for the next six months at approximately half maintenance, after which a full fattening ration was given. It was found that although during the six months on half maintenance the animals lost approximately 25 per cent. of their original live weight, they soon regained this when given a full ration, after which they fattened normally, and, when slaughtered, produced saleable beef. Thus the absence of permanent ill effects of prolonged and severe under-nutrition is clearly demonstrated, but it is unfortunate that the authors were prevented from considering the economic results of their investigation. In the absence of any economic discussion it cannot fail to strike the British reader that the investigation loses much of its importance. Under-nutrition of store cattle during the winter is a common phenomenon in the pastoral districts of the west of England, and when practised on young animals is supposed to be responsible for many of the shortcomings of stores which are transported to the Midlands and the Eastern Counties for subsequent fattening. The publication contains, however, clear descriptions of many very ingenious instruments used in the determination of the digestibility of the feeding stuffs and in the measurement of gaseous metabolism. Many British experimenters would profit by studying the discussion of the accuracy of live weight measurements on which they are apt to place implicit confidence.

PLANT PROPAGATION.—Mr. C. T. Musgrave has an interesting note in the Journal of the Royal Horticultural Society, volume 48, parts 2 and 3, issued September 1923, under the title "Methods of Propagation in an Amateur's Garden," which again directs attention to the numerous problems that immediately arise when the empirical data, alone available in this subject, are passed under review. Mr. Musgrave distinguishes between hardwood cuttings of woody perennials, which have ceased growth for the year, and soft cuttings, among which he distinguishes again between truly soft herbaceous plants, such as the geranium, and the "firmwood" cutting of a shrub such as Escallonia. For firmwood cuttings he agrees with the practice of using a side shoot, torn from the parent stem with a downward pull so that a little "heel" of the main stem is left attached to it. Such "heeled" cuttings are described as almost invariably easy to strike. Fuchsia, on the other hand, strikes better if a piece of stem is cut off just below a node, rather than from a side shoot broken off with a "heel"; clematis again, for some puzzling reason, always roots best if cut about an inch below a node. The author points out that the layering method so frequently adopted with carnations is also very successful with rhododendrons, hardy azaleas, and other hardy shrubs.

ASSIMILATING TISSUE IN THE PLANT.—As first part of vol. iv. of the Handbuch der Pflangenanatomie, edited by K. Linsbauer (Berlin: Gebrüder Borntraeger, 1923), there has appeared a review of the assimilating tissues by Fritz Jürgen Meyer. A full bibliography and index appears with the review. The various forms of assimilating tissue are fully described, palisade and spongy tissue, arm palisade, assimilating epidermis and bundle-sheath, etc., and a résumé given of the various views as to the development from special assimilating tissues. The conclusion seems to be that we have not yet escaped from a somewhat barren controversy as to the relative importance of alternative teleological explanations based upon its assumed functional activity. The main protagonists have been Stahl and Haberlandt. Stahl argued that the palisade system was the ideal system for strong light, the spongy for weak light, hence the relative proportions of these tissues in sun and shade leaves. That light exerts an important influence is supported by the recent experiments of Liese, which show the walls of the palisade cells adopting a different angle when developing in a radiation that comes in different directions. Haberlandt, on the other hand, developed as explanatory principles two adaptational requirements—(1) an increase of cell surface, his main clue to the structure of palisade and arm-palisade tissue; (2) an increase of length in the direction along which assimilates move in the cell, an important guide to the interpretation of spongy parenchyma. Other authors, notably Areschoug and Rywosch, have argued stoutly for the importance of transpiration and the moisture conditions of the leaf, finding various reasons why different types of tissue are best suited to certain moisture conditions. All these views are usefully and critically reviewed in this monograph.

INDIAN AGRICULTURAL STATISTICS.—The agricultural statistics of India for the year 1920–21 have been published in two volumes by the Department of Statistics, Calcutta; the first volume deals with British India and the second with certain Indian states. Among a mass of valuable returns dealing with acreage cultivated, areas under irrigation, extent of different crops and live-stocks, and harvest prices, it may be noted that the total area sown with crops in British India in 1920–21 was 5 per cent. less than the previous year, and represented 34 per cent. of the total land area. Owing to the fact that some areas are sown more than once in the year, the gross sown area really amounts to rather more than this figure. In the native states the sown area was about 40 per cent. of the total land area. Food crops accounted for 82 and 77 per cent. respectively of these two totals. The irrigated area in British India remained practically constant, while in the native states there was a slight increase. The area under cotton showed a decrease of 9 per cent., and the area under oil seeds, 2 per cent. The rainfall was above normal in Bengal and Assam and much of Burma, defective in the United Provinces, Rajputana, and Bombay, and especially so in the Punjab, Sind, and Central India, but excessive in Madras.

AUSTRALIAN NOTONECTIDÆ.—The Australian water-bugs of the family Notonectidæ form the subject of a contribution by Mr. Herbert M. Hale to the Records of the South Australian Museum, vol. ii. No. 3, June 1923. The predominant genus is Anisops, which has eight species; nothing previously appears to have been known concerning its life-history. Mr. Hale has been able to fill this gap to some extent in describing the biology and metamorphoses of the commonest species, *A. hyperion*, which occurs in both running and stagnant water. It was reared upon mosquito larvæ and pupæ, which were eagerly devoured, an average of 200 being consumed by each isolated nymph in less than four weeks. Among other genera, Notonecta and Plea are each represented by a single species and there is but one member of the family Corixidæ—*Porocorixa hirtifrons*.

RECENT SHELLS FROM JAVA.—This first instalment of what promises to be an important catalogue of the "Recent Shells from Java" contains an enumeration of the Gastropoda by Dr. C. H. Oostingh. The work, written in English, is founded on a collection, chiefly of marine shells from Java, which is kept in the Geological Museum of the Agricultural High School at Wageningen (Holland), and of this by far the greater part was made by Prof. J. van Baren. An exact knowledge of the recent molluscan fauna being of much importance for the study of the Upper Tertiary fauna of Java, the author has approached the subject in some detail. That is to say, a copious synonymy, and notes of its distribution in the western Pacific generally, with geological occurrences where known, are given with each species, while there is a very good phototype plate of some of the forms.

THE GLACIATION OF NORTH-EASTERN IRELAND.—Major A. R. Dwerryhouse contributes a remarkable paper on this subject to the Quarterly Journal of the Geological Society of London, vol. 79, p. 352 (Sept. 1923). The area covered is a wide one, from Torr Head to Slieve Gallion, thence across the wild moorland of central Tyrone; then away to the east coast again across Lough Neagh, and down to the narrow inlet of Carlingford Lough. The author recognises this inlet as a true fjord excavated by glacier-ice during the later phase, when the ice-flow from the north-west dominated that from the Irish Sea. Good use is made of the presence of pebbles from Ailsa Craig in inland districts, and the course of the Scottish ice (Firth of Clyde glacier) across the country during the earlier phase is strikingly shown upon the maps (p. 419, etc.). The careful work of years is embodied in this paper of seventy pages, and we can only regret that space has not allowed of the description of the picturesque scenic features added by drift-mounds and eskers to the floors of valleys or the barren surface of the moors. Special attention is paid to the gravel-terraces deposited in ice-dammed lakes, and to the dry gaps as records of overflow-channels throughout the district. It is pointed out that the recognition of the true nature of these channels in north-eastern Ireland dates from the work of the Geological Survey in 1904. Here, as elsewhere in Ireland, Mr. G. W. Lamplugh laid the foundations of a very marked advance.

THE WATER SUPPLY OF NYASALAND.—There exist in Nyasaland large tracts of fertile land which are deficient in water supply. If this defect could be remedied these areas would be available for settlement by natives or Europeans. In Water Supply Paper No. 1, issued as a supplement to the *Nyasaland Government Gazette* of June 30, Dr. F. Dixey considers the possibilities offered by underground water. The rainfall of Nyasaland varies from 30 to 80 inches a year, but the long dry season which follows the rainy season leads to great evaporation of surface water. In consequence, in any improvement of the supply, resource must be had chiefly to underground supplies. The granites, gneisses, and schists of the country are not too favourable in this respect, but in the Shire valley there are extensive alluvial deposits and, west of the Shire river, sandstone and shales overlie the crystalline rocks. It is in the last-named rocks that the problem is most difficult of solution. Dr. Dixey compares the conditions with those obtaining in Southern Rhodesia, where at shallow depths an appreciable supply of water is obtained from percolation in joints and fissures. He believes also that a certain supply may be obtained from shallow depressions, known as "pans" or "vleys," which indicate a considerable depth of weathered rock. In areas unfavourable for wells, the construction of impermeable collecting slopes and storage tanks is recommended. On such a slope a rainfall of 20 inches should yield 450,000 gallons per acre.

VARIABILITY OF TROPICAL CLIMATES.—A series of articles have appeared in the issues of the *Meteorological Magazine* for July, August, and September by Dr. Stephen S. Visher (Chicago) on the above subject. The opinion is held that the general emphasis upon uniformity in the tropics is misleading, and attention is directed to the variations of temperature and wind, while rainfall in lower latitudes is shown to be more variable on the average than the rainfall of higher latitudes. For seasonal range of temperature, amongst many other places, Hong Kong in latitude 22° N. with a range of 20° F. is compared with Glasgow in latitude 56° N. with a range of 12° F. It is pointed out that the latitude of Switzerland receives much more heat from the sun on June 21 than the equator, for the sun at that time is about equally vertical in the two places, while in Switzerland the days are about 4 hours longer. Cold snaps are shown to occur commonly in the tropics from various causes. With respect to variability of rainfall, comparison is made between the wettest and driest years in tropical regions and those in higher latitudes. The wettest years out of the tropics seldom exceed more than double the rain of the driest years, while in the tropics the variation of range is much greater. An important factor in these comparisons is the length of the period dealt with; this is recognised by the author. The total rainfall in wettest years is very much larger in tropical regions than in higher latitudes. The erratic nature of cyclonic storms in different parts of the world is referred to, and for frequency and violence the extremes are said to be greatest in low latitudes.

ATOMIC WEIGHT OF BORON.—We have received a copy of vol. 59, No. 2 of the Proceedings of the American Academy of Arts and Sciences, which contains a paper by Baxter and Scott on a revision of the atomic weight of boron. Taking silver as 107·88, these workers find that boron is 10·82 from analyses of the trichloride and tribromide of boron. Improved methods for the fractional distillation in vacuum of boron halides are also described.

SYNTHESIS OF LECITHIN.—Dr. A. Grün and R. Limpächer reported to the congress of German chemists, recently held at Jena, that older preparations, which had been taken for artificial lecithin, were nothing but choline salts of glycero-phosphoric acid. True lecithin is obtained by the action of diglycerides upon phosphoric anhydride, and subsequent action of choline bicarbonate. The purified product has all the physical and chemical properties of the lecithin prepared from seeds, egg-yolk, and the substance of nerves and brain. Optically active lecithins are also obtainable in this way; the kephalines can be prepared from diglyceride, phosphoric anhydride, and colamine.

NITROGEN CONTENT OF WHEAT GRAIN.—The importance of a high nitrogen content of the wheat grain has led Olson (*Journ. Agric. Res.* xxiv., 1923) to attempt to ascertain whether this can be varied by alteration in the controllable conditions in the environment of the wheat plant. The nitrogen content seemed to be increased by widening the distance between the drills when no irrigation was applied, but under irrigation in another district this effect was not obtained. On the other hand, irrigation *per se* exerted no influence in either direction. As maturity approached, the nitrogen in the plant moved towards the grain, though the actual percentage in the latter decreased, apparently owing to the more rapid infilling of carbohydrates. It would appear that larger quantities of water are required to move the nitrogenous matter than the non-nitrogenous into the grains, and accordingly an ample supply of water should prove beneficial to high rather than to low nitrogen content, which rather contradicts the findings with regard to irrigation. Phosphorus and nitrogen were found to enter the grain simultaneously, thus corroborating the results of other investigators.

LEAD AND PLANTS.—The application of radioactive isotopes as indicators, mainly by Hevesy and Paneth, has proved to be a powerful method of attacking many physico-chemical problems that do not readily lend themselves to direct methods. A further interesting application of this method is given in the current issue of the *Biochemical Journal* (vol. xvii. pp. 439-445, 1923) by Prof. Hevesy (Copenhagen), who has investigated the "Absorption and Translocation of Lead by Plants." Specimens of *Vicia Faba* (horse-bean) were immersed in lead nitrate solutions of different concentrations containing thorium B (isotope of lead) as an indicator, and after ignition of the various parts of the plant their lead content could be found by radioactive measurement of the ash. Quantitative results have been obtained using solutions varying in concentration as much as from 10^{-6} N. to 10^{-1} N. In 24 hours the root of the plant absorbed in the former case 60 per cent. of the lead contained in 200 c.c. of the solution, whereas in the latter case only 0·3 per cent. was absorbed. The amount of lead passing into the stem and leaves is less than 1/10 per cent., and does not vary greatly with the solution concentration, indicating that most of the assimilated lead is bound to the root, and experiments on displacement show that it is associated in the form of a dissociable but not readily soluble salt, and not in combination with carbon. Whereas a 10^{-1} N. solution of a lead salt produces toxic effects on the plant even after 24 hours, more dilute solutions do not. Experiments on the kinetic displacement of assimilated ions by other ions are described in connexion with the phenomenon of "antagonism," according to which certain ions have the capacity of inhibiting the toxicity produced by others.

Cohesion and Molecular Forces.

IN opening a joint discussion on cohesion and molecular forces between Sections A, B, and G of the British Association at its recent meeting at Liverpool, Sir William Bragg emphasised the change of point of view which the analysis of crystal structure by X-rays has brought about. The older view, in which atoms and molecules were pictured as centres of force exerted in all directions, and governed by some power law of the distance between them, has had some measure of success in explaining the principal features of surface tension and some of the departures from perfection in a gas. But in a solid, except possibly in the case of polar compounds, no satisfactory results have accrued. On the newer view we consider, not the aggregate, but the individual, atom or molecule.

It appears to be necessary to say that the very strong forces between atom and atom, molecule and molecule, are limited in their effective range of action to distances much smaller than we have hitherto supposed. Small, it may even be, compared to the distances between the centres of atoms as they lie side by side in a crystal. A crystal conforms so exactly to rules respecting its angular dimensions that it seems impossible to imagine its form to be merely the result of an average of tendencies. The forces of adjustment cannot, therefore, be thought of as a force between two points each representing one of the molecules. On the contrary, it is nearer the truth to think that the adjustment is made so as to bring together certain points on one molecule and certain points on the other. In considering, therefore, the binding of the individual molecules of a solid, the analogy of the electrostatic attraction of two charged spheres is imperfect, and should be replaced by that of two members of a girder structure adjusted until the rivets can be dropped into the holes brought into true alignment. This is seen well in the recent work by Muller and Shearer, and by Piper and Grindley on the structure of the organic fatty acids and their salts. There is no doubt that the ultimate flakes of the crystals of these fatty acids are the monomolecular films investigated by Langmuir and by Adam, and it would appear that in passing from one acid to a homologue of greater molecular weight, each addition in thickness of the ultimate flake is made in complete independence of the previous length, as if the only thing that mattered was the nature of the attachment of one carbon atom to the next. There is no influence of the ends upon the atoms in the middle. Again, we have the forces different at different parts of the atomic surface, as in the case of bismuth and its homologues, in which the atom is attached to three neighbours on one side by bonds differing from those which attach it to its three neighbours on the other.

With regard to the nature of these binding forces three types may be recognised. First, there is the effect set up by the sharing of a pair of electrons by two contiguous atoms, leading to strong and directed attachment. Next, there are actions of a different and generally weaker type manifested in the binding of molecule to molecule in a crystal. We may be sure that this type plays an important part in metals and alloys. Lastly, there are the pure electrostatical central actions. In the case of the polar crystal Born and Landé have made some progress in calculating the effect of this.

One well-known fact in crystal growth is that the faces have different rates of growth, indicating that there may be great differences in the ease with which molecules slip into their places. Into this the element of time may enter, because a molecule may come nearly into its right place and be held there sufficiently long to get settled in by thermal agitation or otherwise. We may suppose that the formation of the crystal begins correctly enough, but that errors of adjustment creep in until the surface becomes somewhat disordered, and the growth ceases because fresh molecules cannot find their proper places to slip into. Without a more detailed knowledge of the active forces localised at various points of atoms and molecules we cannot build up a complete theory of cohesion.

Dr. Rosenhain, who followed, dealt with the simple monatomic bodies—the metals—in which the development of strength and ductility is so pronounced. In his opinion it has now become possible to sketch certain principles from which a general theory of the nature of alloys may arise. The first is that the atoms of two metals in solid solution are built on a simple space lattice, the atoms of the solute metal taking the places of a corresponding number of atoms of the solvent metal, the lattice remaining essentially unaltered. The presence of a "stranger" atom produces a certain amount of distortion which is responsible for the changes in the hardness, strength, melting point, and other properties of the metal. The second principle is that the inter-atomic distance through which interatomic cohesion is appreciable is strictly limited. When increased by any means—thermal expansion, mechanical stress, or "stranger" atoms—a limit is soon reached when the lattice breaks down suddenly with the formation of another phase. On heating, such a change is simply melting; on straining, it is the breakdown of elastic behaviour; and on alloying, we have the limit of solid solubility resulting in the formation of crystals of a new type. In many metals cohesion phenomena are complicated by the occurrence of intra-crystalline slip, which results in plastic deformation under stress by the process of slip along certain planes within the crystal. At the surface of slip there must be a rapid exchange of partners without loss of continuity of bonding. It is interesting that the phenomenon is confined to metals crystallising in the two most symmetrical systems, in which, presumably, the distribution of atoms is sufficiently uniform to permit the passing on of bonds to take place.

The mechanism of ductility by means of slip is intimately connected with diffusion in solid crystals. In Dr. Rosenhain's opinion the process of diffusion of one metal into another, the structure of which is already that of closely packed lattices, may be due to movement or slip of atoms in rows, the requisite stress, which at high temperatures need not be great, being provided by the lattice distortion arising from a concentration of "stranger" atoms in a solid solution of non-uniform concentration. On this view ductile metals should allow diffusion far more readily than brittle. It is well known that brittle metals, like antimony and bismuth, show no appreciable diffusion until quite near the melting point. Moreover, it is known that nickel and copper—two very similar atoms—exhibit extremely slow diffusion as compared with zinc and copper. This fits with the above view and is at the same time not to be expected on the view that metallic diffusion is a kinetic phenomenon similar to that of liquids and gases. On the same principles, a crude picture of the constitution of an amorphous solid fitting the facts in a general way may also be formed.

With regard to the method of binding of two crystal lattice systems growing towards one another, one is struck by the fact that the junction of crystal to crystal is not a region of weakness, but is in fact the strongest part of a crystal aggregate. Metals, when forcibly broken in the cold, normally break through the crystals and not along the junctions. There are a large number of experimental facts supporting the view that the gap between two adjacent lattices is bridged by a region of irregularly arranged atoms constituting a layer of amorphous material of excessive strength.

Finally, while in solid solutions we find that the interatomic distances, though varying a few per cent., are roughly constant, in well-defined intermetallic compounds the interatomic distances are sometimes greatly reduced. Thus, in aluminium, the distance is of the order of 4·3 Å.U., but in the compound $CuAl_2$, aluminium atoms are found with a centre distance of only 2·42 Å.U. In this case, therefore, the nature of the interatomic binding must be quite different, and this probably constitutes the real difference between a compound and a solid solution.

Dr. A. A. Griffith, who followed, pointed out that while at first sight the correlation of data on the breaking strengths of materials with the magnitude of cohesive forces derived by physical method should be comparatively simple, this is far from being the case. One reason for this is that the majority of structural metals are ductile, so that under ordinary stress systems, which almost invariably comprise shearing stresses, the primary failure of the specimen does not involve atomic separation at all but is a failure in shear. Now the mode of collapse of a space-lattice in shear is a subject which has been studied very little by physicists, so that practically no information from the point of view of molecular cohesion is available to engineers.

In the case of certain materials, for example, glass, stone, and hard steel, which exhibit brittle fractures running perpendicular to the direction of the greatest tensile stress, some progress in the subject has been made. Calculations show that in such cases the observed tensile strength is only a small fraction of the calculated molecular tenacity. This discrepancy may be avoided if one assumes the existence of minute cracks in the material fracture being due to the very severe concentration of stress at the corners of the cracks. A formula may be developed which gives results of the right order of magnitude if the radius of the corners of the cracks is taken as two or three molecular spacings. There is another type of fracture obtained with brittle materials, namely, cracks running obliquely to the principal stresses, the best known case being the crushing fracture obtained by simple compression. This may be treated in a somewhat similar manner by the assumption of a large number of minute cracks oriented at random in the material.

With regard to the breakdown of ductile metals, Dr. Griffith and Mr. Lockspeiser have worked out a theory of plastic strain in which the conclusion is reached that plastic strain is simply the external manifestation of phase changes occurring within the material. This view in itself is not new, but the novelty arises from the fact that deductions are made regarding the number and nature of the distinct phases concerned in the action. The question arises whether it is likely on physical grounds that phase changes can occur as a result of the application of a shear stress; given that this is so, the evidence is more in favour of a resultant change in relative orientation of the atoms than of their configuration.

Prof. Lindemann considered that the assumption made by previous speakers that atoms or molecules are either bonded together, or not bonded, is premature, and cited the fact that fairly definite evidence for intramolecular attraction without definite bonds is to be found in the Sutherland correction to the temperature coefficient of the viscosity of gases, derived by assuming mutual attraction of molecules and verified experimentally.

Prof. R. W. Wood mentioned an interesting experiment requiring explanation. A crystal of rock salt placed in hot water can be immediately bent by the fingers, and remains deformed when removed from the water. The range of temperature over which this has been observed is small and the phenomenon does not occur in the case of immersion in hot oil.

To sum up, the discussion brought out clearly the fact that we are still only at the beginning of a complete explanation of the general phenomena, and there was point in the somewhat facetious remark of Sir Oliver Lodge that it was an extraordinary fact that, after all these years, three important sections of the British Association should be gathered together to discuss why, when one end of a stick is raised from a table, the rest of it also comes up.

Paris Meeting of the International Council for the Exploration of the Sea.

THE sixteenth annual meeting of the International Council for the Exploration of the Sea was held in Paris, on the invitation of the French Government, on October 1–5. By the courtesy of the Administrative Council, accommodation was provided for the Council in the Institut Océanographique, founded by the late Prince Albert of Monaco. The following countries, members of the Council, were represented: Belgium, Denmark, Esthonia (for the first time), Finland, France, Great Britain, Holland, Norway, Portugal and Sweden. Representatives of the Irish Free State attended as visitors.

The usual committees and sections for hydrography, plankton, statistics, herring, plaice, cod and haddock, limnology, the Baltic Sea and the Atlantic Slope were assembled, and a new committee, named the North Atlantic Committee, was formed.

It is important to observe that all committees and sections are now instructed to formulate precise programmes of work, allotting to each country concerned a definite part in the programme, which it undertakes to perform. Each country is called upon afterwards to report to the Council on the work it has carried out in accordance with these undertakings, and the effect of these reports is embodied in a general progress report submitted to the Council at each meeting. The tendency to present excellent but unrealisable recommendations is thus discouraged.

For the most part the committees reaffirmed their existing programmes in respect of which generally satisfactory progress was reported. It will be observed that there are three committees for the study of particular fishes. The Plaice Committee, the recommendations of which for the protection of the plaice fisheries were adopted by the Council in 1922, and are now under the consideration of the participating Governments, is chiefly engaged in watching developments and checking its own conclusions.

The intensive investigations of the plaice having thus come to a pause, the study of the herring, cod and haddock is being vigorously prosecuted, in accordance with comprehensive practical programmes adopted in 1921, and afterwards modified in the light of experience. Unfortunately, owing to the difficulties of the time, many of the countries concerned are inadequately equipped for work at sea, and the bulk of the sea work falls on England and Scotland. It is particularly regrettable that Norway, to which, in the person of Dr. Einar Lea, is entrusted the leadership of the herring investigations, has not yet been able again to equip a ship for deep-sea research. The herring investigations at their present stage involve, to a considerable extent, the application to the investigation of North Sea herrings of the methods employed by Hjort and Lea in their investigations of the Norwegian herrings. With a view to the standardisation of these methods, English and Scottish naturalists are studying under Hjort and Lea at Christiania.

The Cod and Haddock Committee is under the convenership of Dr. E. S. Russell; but the work of direction is divided between England and Scotland, the latter being responsible, through Dr. Bowman, for dealing with haddock material and the former with cod.

The proposal to form a North Atlantic Committee was approved after a lengthy debate in a special committee of the whole Council. On one hand it was felt that the committees were already dangerously numerous, that the fishes which would come under examination by the North Atlantic Committee were mainly those actually being investigated by other committees, and that a further extension of the principle of geographical division of work already accepted in the formation of the Committee of the Atlantic Slope and the Baltic Committee created the risk of redundancy unless it could be shown that the area to be studied was, in respect of some at least of its features, self-contained, and presented phenomena peculiar to itself. It was more particularly on the last-named ground that the Danish Commission in a memorandum submitted to the Council supported their proposal, which had for its principal object the study of the fisheries of Iceland and Faroe. They pointed out that the Icelandic fisheries in particular, and the physical conditions governing those fisheries, presented peculiarities which merited individual study. They summarised their argument in the following terms: "In regard to fishery biology as well as hydrography the various parts of the Icelandic area are extremely dissimilar. There is in fact a greater difference in this respect between South and East Iceland than between South Iceland and the Faroes, or, indeed, between South Iceland and Ireland."

The Council eventually resolved to form a North Atlantic Committee for research north of the latitude of Rockall, and, while instructing the Committee to commence work in the area suggested in the Danish Commission's memorandum, urged it to keep in mind the importance of extending its area of observations particularly to the eastern and northern parts of the Norwegian Sea. The Committee was further instructed to arrange its programme in consultation with the other committees concerned. The programme adopted, in accordance with this instruction, provides for the hydrographical and biological investigation of the region, with special reference to cod, haddock, halibut, plaice and herring. The leadership of the work was entrusted to Dr. Johs. Schmidt. The greater part of the sea work will be carried out by means of the *Dana*, but France will make provision for observations by means of cruisers stationed at Iceland, and Scotland will conduct hydrographical-biological cruises from the west of Scotland to the Faroes. England will assist with fishery statistics and measurements.

An interesting discussion arose in connexion with the work of the Statistical Committee, of which Prof. D'Arcy Thompson is permanent chairman. The British delegates were instructed to endeavour to secure the general adoption of more effective and, in particular, more uniform statistical methods, such as are in use in Great Britain. Owing to the lack of uniformity of method, it is at present most difficult to present in the Bulletin statistics which afford a true indication of the actual condition of the fisheries in a given region or part of a region, and of the variations of the stock from year to year. For example, different countries while using the same regional nomenclature have different conceptions of the limits of the regions, and the majority of them are not able to give any accurate idea of the precise locality fished or of the amount of fish of any given species—or of fish of all kinds—taken per unit of time; *e.g.*, the quantity of fish taken in a given area in 100 hours' fishing. Statistics which do not present a picture of the distribution of the stock in time and space are of little value to the scientific worker, and it is for scientific rather than for commercial purposes that the International Council should collect and publish statistics. It was readily agreed by the Statistical Committee that uniformity must be secured in the matter of the designation of statistical regions and areas; but it was impossible in the time at the disposal of the Committee to arrive at unanimity as to the limits by which the regions should be defined. This question was accordingly referred to a special sub-committee which was requested to report to the committee before the next meeting of the Council. The question of getting detailed statistics of locality of capture, *i.e.* fishing ground, and of the relation of fishing power to catch of fish, proved to be one of ways and means, and the reply of most countries was that they had not the staff for the collection of such statistics on the scale adopted in Great Britain. Eventually it was agreed that each country should endeavour to collect statistics from some of its vessels according to the methods employed in England, and an undertaking was given on behalf of the English Department, being the best equipped for the purpose, that the Department would for the present work up the data if sent to them.

The work of the Committee of the Atlantic Slope continues to be under the leadership of Dr. Edouard le Danois. The English Department is not yet in a position to take part in the sea work, but it is hoped that the Marine Biological Association will continue the assistance which it has given in the past.

A memorandum was submitted to the Council by Prof. Otto Pettersson and Commodore C. F. Drechsel advocating an international expedition to study the system of currents of the great oceans, with reference especially, to quote from the memorandum, to the following questions:

"(1) Whether the changes we observe in the fish life of our seas correspond with the changes we observe in the current system of the ocean; and

"(2) Whether these changes are of periodic nature."

The authors of the memorandum, which gave rise to a most interesting debate, urged that advantage should be taken of the fact that the late Prince of Monaco's yacht *Hirondelle* was for sale to secure and equip this vessel and to employ it for four years in an investigation of the questions above stated. They invited the Council to support the proposal, which they desired to submit, with the authority of the Council, to the governments of the civilised world, in the hope of securing the co-operation of all these governments in the enterprise. They pointed out that if the proposal secured world-wide support the actual cost to any individual country would be comparatively small. In the debate which took place upon the memorandum it was freely recognised that the practical difficulties in the way of the realisation of such a scheme would be great. The Council, however, eventually passed a resolution recording its opinion that an increased knowledge of the ocean systems was not merely of scientific interest but of practical importance for the explanation and the forecasting of phenomena affecting life both in the sea and on land, that such an investigation must necessarily be extended over many years, but that it could usefully be initiated by a preliminary reconnaissance on the lines suggested in the memorandum. The Council therefore recommended the proposals to the favourable consideration of the governments and scientific institutions of all countries. In its resolution the Council was careful to point out that such an undertaking as this went far beyond the limits both of its resources and of its mandate, and must be regarded as a distinct and world-wide enterprise. It affirmed, however, its readiness, should the proposal meet with adequate support, to undertake the general direction of the work. It was generally felt that there was no other existing organisation equally competent.

The next meeting of the Council will be held, as usual, in Copenhagen.

Electrometric Methods in Analytical Chemistry.[1]

THIRTY years ago electrometric methods of analysis were too complex for technical purposes, but the importance of "hydrogen ion concentration" re-directed attention to them, with resulting simplification.

When a piece of silver is dipped in a solution, a solution pressure is exerted, silver ions being driven into solution until equilibrium is established between the osmotic pressure of the ions in the solution and the solution pressure of the silver. Hydrogen behaves similarly, as does chlorine. It thus becomes possible to find a suitable electrode for any reaction giving a change in valency.

In the reduction of potassium permanganate the electrolytic potential (ϵ) is given by the formula:

$$\epsilon = \epsilon_0 + \frac{0{\cdot}058}{n} \log \frac{[Mn'']}{[H]^8[MnO_4']}.$$

If the log expression is kept constant there results a normal electrode. In practice such an electrode must be combined with one which changes its potential during the course of the titration. It is possible to titrate silver with halides, sulphides, cyanides, and thiocyanates, and vice versa. An interesting feature is the possibility of the simultaneous titration of halides in admixture, there being successive falls of potential as each is reacted upon by the silver solution. In the presence of protective colloids there is of course no apparent precipitation. It is interesting to note that this does not interfere with the titration.

Protective colloids stop crystal growth and consequently increase somewhat the solubility of the precipitate. This solubility is usually so low that an increase of even 100 per cent. does not lead to appreciable errors. It thus becomes possible to estimate directly small amounts of metal in, say, blood serum. Certain organic substances, such as silver salvarsan, contain silver in such a form that it is not acted upon by chlorides. Use is made of sulphides, the diameters of the ions of which are such that monovalent cations of the dimensions of silver ions are unable to resist their influence. Ionic dimensions play an important part in determining the insolubility of certain precipitates.

Titrating zinc in acid solution with potassium ferrocyanide, curves not of the usual bi-logarithmic type are obtained. The abnormality is due to small amounts of ferric iron. On filtering through aluminium powder, reduction to ferrous iron takes place and normal curves are obtained.

For nickel and cobalt in admixture electrometric titration with potassium cyanide is the best. The complex ions $''Ni(CN)_4$ and $''Co(OH)(CN)_5$ are formed. The curves obtained yield no evidence of the formation of intermediate complexes.

For oxidation and reduction titrations a platinised electrode is most satisfactory. Titanium may be estimated very accurately in the presence of iron after filtration through a cadmium powder filter in an atmosphere of carbon dioxide and subsequent titration with potassium dichromate. If a blank electrode is employed it is liable to become passive at the end of the titration, producing a sudden drop of potential instead of a rise.

With regard to dye-stuffs there is little to add to the excellent methods of Knecht, but where electrometric methods are used, frequent use is made of cadmium filters for reduction. Titrating primary amines in acid solution with sodium nitrite a sudden rise in potential is obtained with the first drop in excess of the latter.

For the estimation of free halogens an example was given of the estimation of 0·1 per cent. of bromine in sodium chlorate by distillation with hydrochloric acid followed by titration with arsenious acid.

An especially resistant electrode for the estimation of insoluble oxides is obtained by passing an alloy of 90 per cent. gold with 10 per cent. copper through a bunsen flame, when it becomes covered with a thin layer of a copper oxide.

In conductivity titrations the conductivity usually changes sharply enough to indicate the end-point, but where weak acids are concerned care must be exercised. Use is made of a Wheatstone bridge and an alternating current. The millivoltmeter may still be used by the introduction of a rotating switch, the poles in the solution being changed six to eight times a second. The current then becomes virtually a continuous one. The method is the best one for alkaloids and also for water in organic liquids. An example of the latter is the estimation of water in so-called absolute alcohol. A salt is added which completely ionises in aqueous solution, *e.g.* potassium perchlorate. The alcohol is rapidly stirred and the conductivity measured. The solubility of the salt is a linear function of the water present, and from an examination of the curves obtained its content may be deduced. Conductivity methods are excellent for determining and comparing the hardness of waters.

The last few years has seen the replacement of electro-deposition methods by titration methods, and very accurate results may now be obtained even with the simplest equipment. The behaviour of titration electrodes requires further study, and from the work now being carried out on surface adsorption and surface actions in general, much progress may be expected in the future.

L. G. R.

[1] Synopsis of a paper presented to the Manchester Sections of the Society of Chemical Industry, Society of Dyers and Colourists, Institute of Chemistry, and the Manchester Literary and Philosophical Society, on November 2, by Prof. W. D. Treadwell of the Technical Highschool, Zürich.

University and Educational Intelligence.

CAMBRIDGE.—The Right Honourable S. M. Bruce has been elected an honorary fellow of Trinity Hall. Mr. P. J. Durrant, Corpus Christi College, has been elected fellow and lecturer in natural sciences at Selwyn College. Mr. R. H. Fowler, Trinity College, has been appointed University lecturer in mathematics.

The desk habitually used by Francis Maitland Balfour and afterwards by Sir Michael Foster—two of the chief founders of the Biological Schools of the University—has been presented by Dr. Michael Foster to the Balfour Library.

The Annual Report of the Special Board for Agriculture and Forestry shows a falling off in the number of students from the excessive numbers immediately after the War. Amongst the notable events in the year's working of the department are included the completion of the purchase of the University farm, the foundation of the professorship of animal pathology, the organisation of the Horticultural Research Station, and the addition of Poultry Sections to the Animal Nutrition Institute and the Genetics Institute.

Trinity College announces a research studentship open to graduates of Universities other than Cambridge, and also exhibitions open to students at present studying at Dominion or Colonial Universities.

DURHAM.—The Newcastle and Gateshead Water Company have granted the sum of 100*l*. to Mr. B. Millard Griffiths, lecturer in botany at Armstrong College, Newcastle-upon-Tyne, to enable him to carry out further researches on the micro-flora (phytoplankton) and the hydrography of the smaller bodies of fresh water.

EDINBURGH.—On November 12, the Right Hon. William Lyon Mackenzie King, Prime Minister of Canada, and the Hon. William Robertson Warren, Prime Minister of Newfoundland, received the honorary degree of LL.D. At the close of the ceremony, Mr. Mackenzie King delivered a short address on the Imperial Conference, which, he said, had proceeded on sound constitutional lines that would be enduring in the development of the political evolution of the British Empire.

LIVERPOOL.—The late Mr. William Prescott has bequeathed 20,000*l*. to the University to found a chair of agriculture or a chair for the furtherance of one or more of the following subjects, namely, the chemistry of agriculture, the cultivation of land, the care, breeding and raising of crops, the diseases of crops, or any other subject connected with agriculture. The University is given twelve months in which to decide whether or not it can accept this gift.

Mr. William Horton has been appointed honorary lecturer in plant histology.

MANCHESTER.—Prof. A. V. Hill has presented a sum of 200*l*. to endow a prize to be awarded for an essay on a biochemical subject.

Mr. Edgar Morton has been appointed assistant lecturer in economic geology.

The following have been elected to honorary research fellowships: Dr. E. D'Arcy McCrea, in physiology; Mrs. Gertrude Robinson, in chemistry; Mr. W. K. Slater, in chemical physiology.

THE Universities of Brussels and Montreal both report gifts of radium among their benefactions during 1922–23. The former participates in a gift of 8 gm. by a mining company to the universities of Belgium, and the latter has been entrusted by the Government of the Province of Quebec with 1¼ gm.

ACCORDING to the *British Medical Journal*, honorary degrees will be conferred on November 24 by the University of Paris on the following distinguished men of science: Sir J. J. Thomson; Prof. Camillo Golgi, emeritus professor in the University of Pavia; Dr. W. W. Keen, formerly professor of surgery in the Jefferson College, Philadelphia, and Prof. S. A. Arrhenius, of Stockholm.

A CLARENCE GRAFF fellowship, tenable for one year by a British graduate of Oxford or Cambridge at any American university located between the Allegheny and Rocky Mountains, has been founded by Mr. Graff, an American banker resident in London. The object of establishing the fellowship, which carries a stipend of 250*l*. plus tuition fees, is "to foster a better understanding in Great Britain of social conditions and currents of opinion in the United States of America." The award will be made by a committee consisting of the secretary of the Universities' Bureau of the British Empire, the director and assistant director of the American University Union in Europe, and the vice-chancellors of the Universities of Oxford and Cambridge, and preference will be given to a student of humanitarian studies. Earlier this year (May 5, p. 621) we referred to the foundation of Henry P. Davison scholarships at American universities for Oxford and Cambridge men, and it is noteworthy that in each case the gifts have come from Americans. They will help to swell the very small number of awards at American universities available to British students compared with the 96 Rhodes scholarships at Oxford for Americans.

PARTY politics have no place in the columns of NATURE, but we are concerned with what is promised or performed by our statesmen or politicians on behalf of scientific progress. We are, therefore, interested in the election address which Mr. H. G. Wells, as Labour candidate for the University of London constituency, has issued, together with a report of a speech on "Socialism and the Scientific Motive." The Labour Party believes, he says, in science and in the scientific motive as a motive altogether superior to profit-seeking. He appeals to university people as people who know something of the work of scientific investigators, artists, men of letters, teachers, and medical men; who know that none of these work for profit or on the profiteering system, but for service, and that the work they do is infinitely better and more devoted than the work that men do for the profit-making motive. This knowledge should enable them to see that if, in accordance with the doctrines of Labour Party Socialism, collective ownership were to replace private ownership in nearly all the common interests and services of the community, these things would be better managed, especially as the Labour Party recognises "the supreme need of scientific knowledge and the necessary leadership of professionally trained men . . . and teachers." The argument is not altogether convincing, but Mr. Wells is at any rate capable of the philosophic point of view, and if he controlled the policy of the Labour Party, universities would not need to fear inconsiderate treatment at the hands of a Labour Government. One wonders, however, how far his attitude would be likely to be adopted by the people who would determine the policy of such a government. Some of the remarks by Labour members in the House of Commons debate on the Oxford and Cambridge Universities Bill were the reverse of reassuring on this point.

Societies and Academies.

LONDON.

Royal Society, November 15.—Sir William **Bragg** and G. T. **Morgan**: Crystal structure and chemical constitution of basic beryllium acetate and propionate. Basic beryllium acetate is shown by X-ray analysis to be a highly co-ordinated compound. The molecule is a perfect tetrahedron, having an oxygen at the centre, a beryllium alone at each corner, and an acetyl group associated with each edge. The crystalline structure is the same as that of diamond. The propionate forms a monoclinic crystal. The propyl group can no longer be arranged so as to possess a plane of symmetry, as in the case of the acetyl; and in consequence the symmetry is much less.—G. I. **Taylor**: Expeiiments on the motion of solid bodies in rotating fluids.—L. C. **Jackson**: Investigations on paramagnetism at low temperatures. Pt. I. Powdered substances. The following paramagnetic substances have been investigated from atmospheric temperature down to the lowest temperature obtainable with liquid hydrogen (about 14° K): anhydrous sulphates, heptahydrated sulphates and ammonium double sulphates of cobalt, nickel, and ferrous iron. These substances follow the Weiss law $\chi(T+\Delta)=C$ at relatively high temperatures, but at the lowest temperatures, (1) susceptibility increases more rapidly with fall in temperature than is given by Weiss law, and (2) the curve of $1/x$ against T possesses a point of inflection; a maximum and a minimum value of susceptibility occur in the region of lowest temperatures. Pt. II. Crystals. The principal susceptibilities of crystals of cobalt ammonium sulphate and nickel sulphate (heptahydrate) have been determined over a temperature range of 290° K down to 14° K. The Curie constant C is same for each of the principal susceptibilities of any crystal. Deviations from the Weiss law in the case of cobalt ammonium sulphate fall into category (1) above, while those of nickel sulphate fall into category (2).—L. C. **Jackson** and H. Kamerlingh **Onnes**: The magnetic properties of some paramagnetic double sulphates at low temperatures. The magnetic susceptibilities of powdered cobalt potassium sulphate, cobalt rubidium sulphate, manganese ammonium sulphate, have been measured at temperatures from atmospheric temperature down to about 14° K. The two cobalt compounds confirm the results given above for cobalt ammonium sulphate. Manganese ammonium sulphate obeys the Curie law, $\chi T=$const., down to the lowest temperature investigated. This result fits well with the known behaviour of other manganese salts, showing that in this series of compounds the substance follows Curie's law more closely the greater its "magnetic dilution."—H. H. **Potter**: Some experiments on the proportionality of mass and weight. The gravitational accelerations of lead, steel, ammonium fluoride, bismuth, paraffin wax, duralumin, and mahogany have been compared with that of brass, and no difference greater than that attributable to experimental error has been found. An accuracy of one part in 50,000 has been obtained. Special attention has been given to two substances, ammonium fluoride and paraffin wax, which have large hydrogen contents.—Lord **Rayleigh**: Further studies on the glow of phosphorus and its extinction by moist oxygen. The velocity of blast necessary to blow away the glow of phosphorus increases enormously with rise of temperature. On the other hand it is enormously diminished by enriching the air blast with oxygen. In either case the range examined was of order 1000 times. This velocity of blast measures rate of propagation upstream of glow through mixture of phosphorus vapour and oxygen. Where the velocity is reduced, by cooling or by adding oxygen, to less than 1 cm./sec., the condition of extinction is approached. From this viewpoint the known extinction by moist oxygen alone is the limiting case of slow propagation. Hence extinction is due to failure of the process causing propagation, probably a catalytic action of products of combustion. Excess oxygen, like other inhibiting substances, "poisons" these products.—H. A. **Wilson**: An experiment on the origin of the earth's magnetic field.—H. **Robinson**: The secondary corpuscular rays produced by homogeneous X-rays. The Robinson-Rawlinson method of investigating velocities of secondary cathode rays produced by X-rays has been developed with the view of increased accuracy. Special attention has been paid to homogeneity of the primary X-ray beam. The velocities of secondary electrons are measured by deflexion in the magnetic field of a pair of large Helmholtz coils. The copper K_a rays are used as primary X-radiation. Five of the N absorption edges of bismuth have been measured, the remaining two not being separated from the O rings. All five M edges have been measured for atoms as light as tungsten. The L limits have been measured as far as copper, and the K limits to oxygen. Progressive changes occur along the series of elements in the relative intensities of different members of the same group.—J. W. **Gifford**, with an introduction by T. M. **Lowry**: Some refractive indices of benzene and cyclohexane.—J. A. V. **Butler**: A note on the significance of the electrode potential. A thermodynamical argument given in Heyrovsky's paper on the significance of the electrode potential contains stages of the cyclic process employed which are irreversible; hence the conclusions are erroneous. When the cyclic process is conducted reversibly, the sum of the differences of potential round the cycle is zero; therefore no information regarding the relations between the electrode potentials and the various chemical equilibrium constants is obtained by the use of a cyclic process of this kind.

Mineralogical Society, November 6 (Anniversary meeting).—Dr. A. Hutchinson president, in the chair.—L. J. **Spencer**: Euclase and platinum from diamond-washings in British Guiana. Small disks resembling fossil corals consist of a radial aggregation of euclase crystals so arranged that the plane of symmetry is always parallel to the surface of the disk. These, together with tourmaline, diamond, gold, and platinum, were found in the conglomerates near the Kaieteur Falls on the Potaro River. Platinum has not hitherto been recorded from British Guiana.—H. E. **Buckley**: Some anomalous optical properties of freshly-prepared mixed crystals of the Seignette salts. In the orthorhombic and isomorphous Seignette salts the sodium-potassium tartrate has the optic axial plane parallel to the brachy-pinacoid, whilst in the sodium-ammonium salt it is parallel to the macropinacoid. Mixed crystals of the two salts show, as would be expected, the optic axes for different colours in two planes at right angles (as in brookite), but only after the crystals have been prepared for some time. Freshly-prepared mixed crystals exhibit crossed dispersion of the monoclinic type (as in borax). A maximum angle of 75° between the axial planes for red and violet light is given by crystals containing 45 per cent. sodium-potassium tartrate. On standing, the axial planes slowly migrate to the planes of symmetry, and equilibrium is established in from two to thirteen weeks, this being hastened by increasing the temperature.—N. T. **Belaiew**: On the genesis of Widmanstätten structure in meteorites and in terrestrial alloys. The Widmanstätten structure belongs to the triad of secondary structures, the other two being the structure of large crystals and the network structure. Under suitable conditions either of these structures may occur in iron-carbon alloys or in any other alloys crystallising in the face-centred cubic lattice and exhibiting the same kind of equilibrium diagram. As the diagram of the iron-nickel alloys is quite similar to that of iron-carbon, the same kind of crystallisation may be expected in both cases and also in meteorites. The well-known Widmanstätten figures in meteorites are also arranged in a Widmanstätten structure, and the conditions to which they owe their appearance are a very slow cooling after solidification in the granulation zone and a relatively rapid separation of the constituents afterwards in the zone of secondary crystallisation leading to their lodging themselves parallel to the octahedral planes in every granula.—L. R. **Wilberforce**: Illustration and detection of inclined and horizontal dispersion in bi-axial crystals. If the optic picture of an ordinary bi-axial crystal is viewed through a prism the refracting edge of which is parallel or perpendicular to the axial plane, the appearances characteristic of horizontal and inclined dispersion respectively are produced. Such dispersions in a crystal, if too small to be detected by direct observation, can be discovered by thus using a prism of small angle alternately to reinforce and oppose them, and noting the want of symmetry in the effects produced.—A. **Russell**: On the occurrence of the rare mineral nadorite in Cornwall, and of beraunite (eleonorite) in Co. Cork, Ireland. A single specimen of the rare mineral nadorite was found at the small antimony mine Bodannon, St. Endellion, Cornwall. It forms aggregates of nearly square platy crystals, transparent, of a yellowish-brown to reddish-brown colour, occupying a cavity in fibrous jamesonite. The crystals are combinations of *a* (100) and *r* (130) and are twinned on *l* (011). A very well-defined specimen of the variety of beraunite known as eleonorite, found at the iron and manganese mine of Roury Glen, Glandore, Co. Cork, consists of a mass of diverging fibrous crystals of a reddish-brown colour, between walls of limonite. The fibres are elongated in the direction of the *b* axis and show very strong pleochroism.—A. F. **Hallimond** and F. R. **Ennos**: On stilpnomelane, from North Wales. A dark scaly vein-mineral, strongly resembling biotite, proves on analysis to contain very little potash, and is very similar in physical properties to stilpnomelane from Moravia. The composition appears to be $6SiO_2 \cdot 2Fe_2O_3 \cdot 2FeO \cdot 3H_2O$; sp.g. 2·85; apparently uniaxial; o = 1·687, e = 1·595; pleochroic, o = dark brown, e = pale yellow; brittle, with eminent basal cleavage and marked cleavage normal to this, yielding pleochroic chips; H = 3·5; insoluble in hot N/2 HCl.—G. T. **Prior**: On the chemical composition of the Ashdon meteorite: This meteoric stone which fell at Ashdon near Saffron Walden, Essex, on March 9, 1923, is a white hypersthene-chondrite containing 8¼ per cent. of nickeliferous iron in which the ratio of iron to nickel is about 6 to 1.

CAMBRIDGE.

Philosophical Society, October 29.—Mr. C. T. Heycock, president, in the chair.—W. J. **Harrison**: On the motion of spheres, circular and elliptic cylinders through viscous fluid.—E. A. **Milne**: On the derivation of the equations of transfer of radiation and their application to the interior of a star.—F. P. **White**: (1) The conics through fives of six points. (2) Certain nets of plane curves.—C. G. **Darwin** and R. H. **Fowler**: Some refinements of the theory of dissociation equilibria.—J. C. **Burkill**: The fundamental theorem of Denjoy integration.—D. R. **Hartree**: On the correction for non-uniformity of field in experiments on the magnetic deflexion of β-rays.—T. M. **Cherry**: On the solution of certain difference equations.—W. **Burnside**: On the formulæ of one-dimensional kinematics.—W. P. **Milne**: Note on the twelve points of intersection of a quadri-quadric curve with a cubic surface.—E. S. **Bieler**: The effect of deviations from the inverse square law on the scattering of α-particles.—W. M. H. **Greaves**: The stability of the periodic states of the triode oscillator.—D. **Keilin**: The structure and life-history of Lipotropha n.g., a new type of Schizogregarine, parasitic in the fat body of a dipterous larva (Systenus).

MANCHESTER.

Literary and Philosophical Society, November 6.—R. H. **Thouless**: The psycho-galvanic phenomenon. The psycho-galvanic phenomenon is the change which takes place in the bodily resistance during emotion. It may be measured by placing electrodes on the palm and back of the hand, and balancing the resistance so obtained in a Wheatstone bridge circuit. The threat to prick the subject with a pin may produce a reduction of more than 1000 ohms in a total resistance of 12,000 ohms. The exact physiological change producing this result is not known, but we are clearly measuring one of the many involuntary bodily changes which accompany emotion. One person may react much more readily than another. Possibly this may be due to differences in temperament or to such prosaic causes as differences in the dryness of the skin. Similarly, differences in the resistance changes of the same person on different days are as likely to be due to simple physiological changes as to differences in his mood. What may reasonably be assumed is that one person during the course of one sitting gives greater resistance changes for greater emotion and vice versa; though after a resistance change, there is a long period of slow recovery, and the extent of a new deflexion probably depends in part on what stage in recovery has been reached.

PARIS.

Academy of Sciences, October 29.—M. Albin Haller in the chair.—The president announced the death of M. Maurice Leblanc, member of the section for the application of Science to Industry.—J. **Costantin** and L. **Dufour**: A secondary disease of the oak caused by *Polyporus* (*Phellinus*) *rubriporus*. The growth of this fungus is very slow, attacking the tree always near the soil level. Details are given of thirty-two trees attacked by this disease. Owing to its slow growth and the fact that the fungus can enter the tree only at a damaged spot, the disease is unlikely to prove troublesome.—Viggo **Brun**: The direct study of Riemann's $f(x)$.—A. **Guillet**: The mechanical determination of the relative course of two pendulums. A comparator with a chronometric motor.—A. **Damiens**: The dynamic allotropy of mercuric iodide. The author has repeated some recent experiments of Smits and Bokhorst on the change of the red into the yellow varieties of mercuric iodide. While the experimental results agree, under certain conditions, the author's interpretation differs entirely from that of the above workers. The necessity for a new theory of allotropy does not appear to be proved, and the characteristics presented by the allotropy of mercuric iodide can be readily explained by the usually accepted theory.—René **Audubert**: The action of light on metal electrodes with small solution pressures.—André **Graire**: The estimation of sulphonitric and sulphonitrous acids. None of the methods of analysis of commercial products in general use gives satisfactory results. The author gives a preference to the Schloesing method with ferrous chloride.—M. **Bourguel**: The action of sodium amide on the chlorides derived from an aldehyde or a ketone by the use of phosphorus pentachloride. Sodium amide is a more satisfactory reagent for the removal of hydrochloric acid from these chlorine compounds than dry potash or alcoholic potash. The yields are higher and the products purer.—V. **Crémieu**: The variation in the composition of gases spontaneously evolved from thermal springs produced by earthquakes.—V. **Agafonoff**: The limit of the accumulation of humus in soils, with reference to observations on soils of the Nièvre.—G. **Pontier**: The fossil elephants of England: the mammoth in England and in the North Sea.—V. **Lubimenko** and Mme. S. **Fichtenholz**: Contribution to the study of the physiological rôle of the nervation of leaves. The main function of the nervation of the leaf is the mechanical support of the limb. The transport of water is only a minor function.—E. **Aubel** and R. **Wurmser**: The formation of glucose at the expense of alanine and of lactic and pyruvic acids. Experiments on dogs proved that 92 per cent. of alanine and lactic acid are transformed by the animal into glucose, but that in the most favourable case only 80 per cent. of the pyruvic acid underwent this transformation.—A. **Quidor** and Marcel A. **Hérubel**: The psycho-physiology of the visual phenomena in animals.—H. **Barthélemy**: The impregnation of the uterine eggs of *Rana fusca* and of *Bufo vulgaris* after immersion in water or in aqueous solutions of common salt.—J. **Bridré** and A. **Donatien**: The micro-organism of contagious agalaxy and its culture *in vitro*. Cultures of this organism have been made in tubes, details of the technique followed being given. The activity of the cultures was proved by experiments on sheep and goats. The organism was visible after staining by the slow method of Giemsa, after fixing the colour (May-Grünwald).—MM. **Brocq-Rousseau, Forgeot,** and **Urbain**: Serotherapy against glanders in the horse.

Official Publications Received.

Ministry of Finance, Egypt: Coastguards and Fisheries Service. Report on the Fisheries of Egypt for the Year 1922. By G. W. Paget. Pp. vi+49. (Cairo: Government Publications Office.) P.T. 5.

University College of North Wales. Calendar for Sessions 1922-23 and 1923-24. Pp. 425. (Bangor.)

Diary of Societies.

MONDAY, NOVEMBER 26.

FARADAY SOCIETY (at Institution of Electrical Engineers), at 3.—General Discussion on Electrode Reactions and Equilibria. Part I. Conditions of Equilibrium at Reversible Electrodes.—Dr. E. K. Rideal: Introductory Address—The Mechanism of the Reversible Electrode.—Prof. E. Bülmann: Oxidation and Reduction Potentials of Organic Compounds.—Dr. J. Heyrovsky: The Process at the Mercury-dropping Cathode. Part I. The Deposition of Metals.—Prof. A. W. Porter: Note on the Standardisation of the Sign of the Potential.—Dr. J. N. Pring: The Determination of Affinity Constants by the Hydrogen and Quinhydrone Electrodes.—Prof. E. Baur: Electrode-Potentials on Non-Aqueous Solutions.—M. Shikata: Concentration Cells and Electrolysis of Sodium Ethoxide Solutions.—J. A. V. Butler: Studies in Heterogeneous Equilibrium. Part II. The Kinetic Interpretation of the Nernst Theory of E.M.F. Part III. A Kinetic Theory of Reversible Oxidation Potentials at Inert Electrodes.—At 5.30.—Part II. Irreversible Electrode Phenomena.—Prof. A. J. Allmand and H. J. T. Ellingham: Introductory Address.—Prof. A. Smits: Electromotive Equilibrium and Polarisation.—N. V. S. Knibbs: The Gas Film Theory of Overvoltage.—U. R. Evans: The Influence of Obstructive Films in Anodic Processes.

INSTITUTE OF ACTUARIES, at 5.—J. M. Laing: Notes on the Industrial Assurance Act, 1913.

ROYAL SANITARY INSTITUTE, at 5.—Miss M. A. Payne: Sanitary Relief Work in Russia.

ARISTOTELIAN SOCIETY (at University of London Club), at 8.—Prof. J. W. Scott: Some Reflections on the Incidence of Mathematics: Physical Speculation in Philosophy.

ROYAL SOCIETY OF MEDICINE (Odontology Section), at 8.—A. T. Pitts: (1) (?) Dermoid Cyst of Mandible; (2) Dentigerous Cyst apparently arising from a Supernumerary Tooth.—J. G. Turner and others: Discussion on Pyorrhœa, its Prevention and Treatment.

TUESDAY, NOVEMBER 27.

ROYAL SOCIETY OF ARTS (Dominions and Colonies Section), at 4.30.—Viscount Burnham: The West Indies.

ROYAL SOCIETY OF MEDICINE, at 5.—General Meeting.

INSTITUTION OF AUTOMOBILE ENGINEERS (at Institution of Mechanical Engineers), at 6.30.—Demonstration and Discussion of Ignition Systems.

ROYAL PHOTOGRAPHIC SOCIETY OF GREAT BRITAIN, at 7.—Dr. C. E. K. Mees: Chemistry and the Motion Picture.

OPTICAL SOCIETY (at Imperial College of Science and Technology), at 8.—Dr. M. von Rohr: Contributions to the History of the Spectacle Trade from the Earliest Times to Thomas Young's Appearance (Thomas Young Oration).

ROYAL ANTHROPOLOGICAL INSTITUTE (Special Meeting) (at Royal Society), at 8.15.—Dr. E. H. Hunt: Hyderabad Cairn Burials and their Significance.

WEDNESDAY, NOVEMBER 28.

ROYAL MICROSCOPICAL SOCIETY (Industrial Applications Section), at 7.—J. E. Barnard: Lecture Demonstration.—Dr. S. H. Browning: The Application of the Microscope to Industrial Diseases.—C. A. Newton: The Microscope in the Examination of Condensed Milk.

ROYAL SOCIETY OF ARTS, at 8.—Sir Henry J. Gauvain: The Effect of Sun, Sea, and Open Air in the Treatment of Disease.

BRITISH PSYCHOLOGICAL SOCIETY (Medical Section) (at Royal Society of Medicine), at 8.30.—Dr. M. D. Eder: The Sting of Death.

THURSDAY, NOVEMBER 29.

INSTITUTION OF MINING ENGINEERS (Annual General Meeting) (at Geological Society), at 10.30 A.M.—Prof. R. W. Dron: Hydraulic Stowage at the Dalzell and Broomside Collieries.—Prof. K. N. Moss: Some Effects of High Air-temperatures upon the Miner.—T. D. Jones: Strata Temperatures in South Wales, including Pembrokeshire.—G. Coles: The Specific Heat of Coal.—Sir William Ellis: The Position of Mechanical Engineering in Colliery Operations.

MEDICAL OFFICERS OF SCHOOLS ASSOCIATION (at 11 Chandos Street, W.1), at 5.15.—Dr. H. Crichton Miller, Dr. H. C. Cameron, and others: Discussions on The Nervous Child.

ROYAL AERONAUTICAL SOCIETY (at Royal Society of Arts), at 5.30.—Major R. H. Mayo: The Development of High-speed Aircraft.

ROYAL SOCIETY OF MEDICINE (Balneology and Climatology Section), at 5.30.—Dr. C. W. Buckley and others: Discussion on Diuresis.

PHYSICAL SOCIETY OF LONDON AND INSTITUTION OF ELECTRICAL ENGINEERS (at Institution of Electrical Engineers), at 5.30 and 8.—S. G. Brown, Capt. P. P. Eckersley, Prof. C. L. Fortescue, Prof. J. T. MacGregor-Morris, Prof. E. Mallett, L. C. Pocock, H. L. Porter, Prof. A. O. Rankine, E. K. Sandeman, and G. A. Sutherland: Discussion on Loud Speakers for Wireless and Other Purposes.

FRIDAY, NOVEMBER 30.

ROYAL SOCIETY, at 4.—Anniversary.

INSTITUTION OF MECHANICAL ENGINEERS, at 6.—Prof. A. L. Mellanby: Clyde Marine Oil-Engines.

ROYAL PHOTOGRAPHIC SOCIETY OF GREAT BRITAIN, at 7.—A. J. Bull: The Weald, its Scenery and Structure.

JUNIOR INSTITUTION OF ENGINEERS, at 7.30.—S. C. Saunders: Notes on Design of Paraffin Motors.

SATURDAY, DECEMBER 1.

GILBERT WHITE FELLOWSHIP (at 6 Queen Square, W.C.1), at 3.—F. R. S. Balfour: Trees and Flowers of the North-West Pacific Coast.

PUBLIC LECTURES.

SATURDAY, NOVEMBER 24.

HORNIMAN MUSEUM (Forest Hill), at 3.30.—Miss E. Goodyear: The Romance of the Highways.

TUESDAY, NOVEMBER 27.

KING'S COLLEGE, at 5.30.—Miss Hilda D. Oakeley: The Roots of Early Greek Philosophy: Religious.

UNIVERSITY COLLEGE, at 5.30.—W. J. Perry: The Pan-Pacific Congress.

WEDNESDAY, NOVEMBER 28.

ROYAL INSTITUTE OF PUBLIC HEALTH, at 4.—Miss K. Platt: Problems in relation to Health in the Tropics.

THURSDAY, NOVEMBER 29.

LONDON SCHOOL OF ECONOMICS, at 5.30.—G. N. Clark: Holland and Belgium and Europe (League of Nations Union Lecture).

UNIVERSITY COLLEGE, at 5.30.—Sir William J. Collins: The Life and Doctrine of Sir Edwin Chadwick.

SATURDAY, DECEMBER 1.

HORNIMAN MUSEUM (Forest Hill), at 3.30.—H. N. Milligan: The Natural History of Dragons.