THURSDAY, FEBRUARY 8, 1917.

SEA-TROUT.

The Sea-Trout: a Study in Natural History. By H. Lamond. Pp. xi+219. (London and Manchester: Sherratt and Hughes, 1916.) Price 21*s.* net.

IN a handsome and well-illustrated volume Mr. Lamond gives us the results of his studies on the life-history and habits of the sea-trout of Loch Lomond and the Clyde estuary—a subject on which he writes with first-hand knowledge.

Most authorities are agreed that our migratory and non-migratory trout are the same species, and it is interesting to find that this view is confirmed by Mr. Lamond's observations. He writes that in the spring it is a practical impossibility to distinguish young trout two or three years old from sea-trout parr of equal age, and that in the later months sea-trout that have been in the loch for a few weeks and have lost their silvery sheen approximate in appearance so closely to the native non-migratory trout that it is difficult to distinguish between them.

According to Mr. Lamond, non-migratory Loch Lomond trout may descend to the Clyde estuary and even return with sea-lice—from which one might infer that a trout is only migratory and a sea-trout when it actually reaches the sea; but later we are told that the sea-trout is essentially an estuarine fish, and may be found at all stages in the Clyde estuary. In fact, in structure, appearance, or in habits there does not seem to be any real distinction between trout and sea-trout.

The salmon, of course, is quite another species, and in the eastern Atlantic, where salmon and trout occur together, they differ both in structure and in habits. The salmon goes farther out to sea, grows faster, and attains a larger size than the trout; it does not form non-migratory colonies except in lakes such as Wenern and Ladoga, which are sufficiently large to excuse it for thinking it has reached the sea; it spends at least one winter in the sea before returning to its parent river, whereas a large proportion of the sea-trout return as "whitling," after only a few months in the sea, to spend the winter in fresh water; finally, the salmon breeds only once or twice, rarely more often, in its life, whereas trout are annual spawners.

Mr. Lamond rightly insists that legislation must be based upon reason and a full understanding of the life-history and habits of the species, and he raises the question whether the fishery laws dealing with salmon and trout are not in need of revision. Legally, it appears, a sea-trout is a salmon, and a trout is something quite different.

When dealing with subjects outside his own particular province, the natural history of the trout of the Clyde area, Mr. Lamond's grip is less firm. For example, he mixes up two perfectly distinct questions: (1) Whether it is worth while to recognise the trout of our eastern and western coasts as separate races on account of certain slight and inconstant differences between them; and (2) whether the "bull trout" of the Tweed, Coquet, etc., is merely a large sea-trout or a distinct species. He thinks the bull trout will prove to be a separate species, but his grounds for this belief are quite insufficient, being mainly that growth is more rapid than is usual in sea-trout.

A curious slip is the description of the axillary process of the pelvic fin as "a little rudimentary or, it may be, an aborted fin." But mistakes of this kind do not lessen the merit of the book, which contains a lot of information about a species that has not been sufficiently studied, and is a work of considerable interest and of real value.

C. T. R.

PHOTOGRAPHIC RECORDING.

The Camera as Historian: a Handbook to Photographic Record Work for those who use a Camera and for Survey or Record Societies. By H. D. Gower, L. Stanley Jast, and W. W. Topley. Pp. xv+259. (London: Sampson Low, Marston and Co., Ltd., 1916.) Price 6*s.* net.

MUCH may be said in favour of the opinion that there is no more desirable work to which photography can be applied than that which is generally understood by the terms "photographic record" or "photographic survey" work. And yet, so far as we are aware, the authors of this volume are correct in stating that this is the first attempt to produce a manual on the subject. The authors are well fitted for the task that they have undertaken, having had considerable experience as officers of the Photographic Survey and Record of Surrey, and two of them in connection with public libraries. In a quite true sense every photograph is a record, and although a very large proportion of the photographs taken have only a trivial, temporary, or it may be a purely personal interest, others are of the greatest value, and will increase in value as time passes and the objects represented change or disappear. But the practical value of such photographs is exceedingly small, or even nothing, so long as they remain hidden away in private collections or lumber-rooms. The duty of record societies is to systematise the work so that it may proceed along definite lines, and to classify, arrange, and index the photographs. They then become available for reference like books in a public library. It is not only the archæologist and historian who are interested in such collections, but questions that relate to ancient lights, rights of way, etc., may sometimes, by reference to them, be answered with a certainty that will obviate disputes and expensive litigation.

The value of photography for such work as compared with hand-drawn records scarcely needs emphasis, but an excellent example that ought to convince the most sceptical is given by the authors in reproductions of a photograph and an archi-

tect's drawing of a wrought-iron lock in Beddington Manor House. Both were made for the purpose of record; the differences are surprising, and the superiority of the photograph is obvious at a glance, and still more so on a detailed examination.

Those who have not considered the matter would be surprised at the variety of subjects that are dealt with. The following is a table of the "main classes" given, each of which is to be interpreted very broadly:—Topography, art, literature, geology, palæontology, zoology, botany, horticulture and agriculture, architecture, antiquities, meteorology, passing events; and space is left for other classes.

Although the work is as yet only in its early stages, about fifty thousand photographs have been deposited and catalogued for reference in various public libraries and museums. The authors give as complete details as they have been able to obtain of the extent of the work which has already been done and is now going forward, with the methods adopted in various places for classifying and storing the records, and many valuable suggestions as to ways of popularising the work (for so far it has been done almost entirely by amateurs as a labour of love). They treat also of those little differences in manipulation that add much to the value of the record and little, if anything, to the trouble of making it, such as the indication of the scale of the photograph, the time of day, etc.

We recommend a study of the volume not only to those who are already interested in record work, but to photographers in general, whether professional or amateur. C. J.

OUR BOOKSHELF.

Fertilizers. By the late Prof. E. B. Voorhees. Revised edition by Prof. J. H. Voorhees. Pp. xv+365. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1916.) Price 6*s.* 6*d.* net.

THE first edition of this book was issued in 1898; since then it has been reprinted no fewer than sixteen times, and now it is revised by Prof. J. H. Voorhees and re-issued. The second edition is rather larger than the first, but not much, the subject-matter having been left very much as it was before, with a few additions to bring the book up to date. Thus, some illustrations have been added which increase the interest of the book, and a new chapter has been put in on farmyard manure and green manuring.

The treatment is general rather than special, and only few references to original papers or bulletins are given. We think this ought to be remedied; even an elementary student ought to be put into touch with the sources from which the information presented to him is derived. Modern books show an increasing tendency in this direction, which, of course, is wholly good.

Some of the newer work is not dealt with as one would like, the treatment of the new synthetic nitrogenous fertilisers, calcium cyanamide and calcium nitrate, being very brief. Further, the only mineral phosphates described are those of the United States; no mention is made of such important substances as Gafsa phosphate or Algerian phosphate. In the chapter on farmyard manure, also, we note that gypsum, rock phosphate, kainit, and acid phosphate are all recommended as conserving agents, although many experiments have shown that their action is very small.

One other point ought to be remedied: the factors for converting nitrogen into ammonia, etc., are given to four places of decimals; two are usually sufficient, and more than three are never wanted.

The book retains its distinguishing features and will no doubt prove helpful to the type of student who used the previous edition.

Australia. By Prof. J. W. Gregory. Pp. 156. (Cambridge: At the University Press, 1916.) Price 1*s.* 3*d.* net.

AUSTRALIA is sometimes represented as a fringe of inhabitable land round a useless desert, with a stagnant population, an easily exhausted soil, a national debt of more than 60*l.* a head—in sum, as a country tending to inevitable bankruptcy under the incompetent rule of envious demagogues. Such is the view of Australia which Prof. J. W. Gregory has found little difficulty in proving untenable in this small book. Within its limited compass he has provided considerable information; for example, in the case of Western Australia he shows that the rainier half of that State has already been settled by pastoralists, and contains a rich cattle-breeding country; again, in a convincing chapter on the Government of Australia, he shows that the Labour Party in Australia is misunderstood in Britain, and is led by capable statesmen. With reference to the policy of "White Australia," it is demonstrated that the employment of white labour to displace the Kanakas—one of the most daring of all Australian industrial experiments—has resulted in considerable progress in the cultivation of sugar-canes in Queensland.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or 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 Aurora, Magnetic Storm, and Sun-spot of January 4.

THE Aurora Borealis of January 4, 1917, described by Mr. Denning and Dr. Rambaut in NATURE of January 18, was also observed by Mr. Alfrel Noël Neate, at Carlisle. He has kindly sent me the following description of the display:—"I observed a very great display of aurora on Thursday evening, January 4. The principal display was observed by me at about 10.45 p.m., but I had seen a lesser one at 5.45 p.m. Notwithstanding the advanced phase of the moon, the whole northern half of the hemisphere

was affected by it, and had the moon been absent the sight would have been truly magnificent. As it was, great beams shot up vertically and horizontally, the latter forming great arches, and the former appearing like searchlights. Frequently an immense area of the sky would become illuminated as if by a great cloud of mist, and the light would pass up to the zenith with lightning rapidity, appearing like clouds of light being wafted upwards from the N. horizon. The clouds were mostly greenish, like a gas-mantle, but the background of the sky was pale ruby."

The magnetic storm of considerable violence which accompanied this auroral display affected the magnets between the hours January 4, 3.36 p.m., and January 5, 2.48 a.m., G.M.T. The greatest range in declination was 57′, in horizontal force 50′, and in vertical force 52′, where in force $1' = 4{\cdot}6\ \gamma$ ($\gamma = 10^{-5}$ C.G.S. unit). Mr. Neate mentions 5.45 p.m. as the hour of a lesser display, and Mr. Denning 8.30 p.m. as the time of the appearance of an auroral streamer. Both these times approximately were marked by rapid oscillations in all three elements. The ranges were, in the first instance, declination 40·4′, horizontal force 40·2′, and vertical force 19·6′, and, in the second instance, 40·0′, 29·7′, and 10·5′ respectively. Dr. Rambaut gives the hour 10.15 p.m. for the finest display of streamers, and Mr. Neate the hour 10.45 p.m. This period was also marked by a series of oscillations on the three curves, but not so rapid or of such large amplitude as the former ones.

On December 30, 1916, a very large round spot of regular outline was glimpsed through clouds near the E. limb of the sun. On January 4, when it was about 13° to the west of the central meridian, it had the appearance of an elongated spot with considerable penumbra and two nuclei, followed by two smaller spots. Another group of two large spots about the same distance east of the central meridian followed it on almost the same parallel of latitude. A small round spot was also near the W. limb. These spots, in the northern hemisphere, were all the spots visible on that date. The area of the large spot was 9 units, in terms of the 1/5000 of the visible disc, and its position was: latitude +14°, and longitude 136°, heliographic. It was a new outburst, though contiguous to a region which had been disturbed as late as October 19, 1916. By January 6 the main spot had split into two, and the surrounding area showed much activity. On January 9, when it was near the W. limb of the sun, there was a whole series of groups of small spots, almost on the same parallel of latitude, stretching from the W. to the E. limb of the sun. In addition to the large group, which, though born on the invisible hemisphere of the sun, was active between January 4 and 6, the subsequent appearance of no fewer than five groups of small spots, three of which were new formations, was further evidence of a disturbed condition of the solar surface. On January 24 extensive and bright faculæ marked the position of the large spot on the sun's E. limb.

A. L. CORTIE, S.J.
Stonyhurst College Observatory,
January 25.

Forms of Weathering in Magnesian Limestone.

SEVERAL distinct forms of weathering are met with in the Sunderland Magnesian Limestone, two of which I will describe, leaving two others for another occasion. In one of them the prevailing rod, or the retiform, structure has been altered into one closely resembling a coral, *e.g. Lithostrotion basaltiforme*. Many of the short columns, consisting chiefly of calcium carbonate, have now numerous thin bands across their long axis (shown by arrow), producing the coral-like appearance, due, I suppose, to rearrangement in a periodic series of the carbonate of lime molecules. They have a fairly uniform thickness of about 1/30 of an inch, with slightly less interspaces. Thus far I have only met with this structure in this unique concretionary limestone, where it has been exposed several years.

The specimen shown in Fig. 1 was cut off a pinnacle

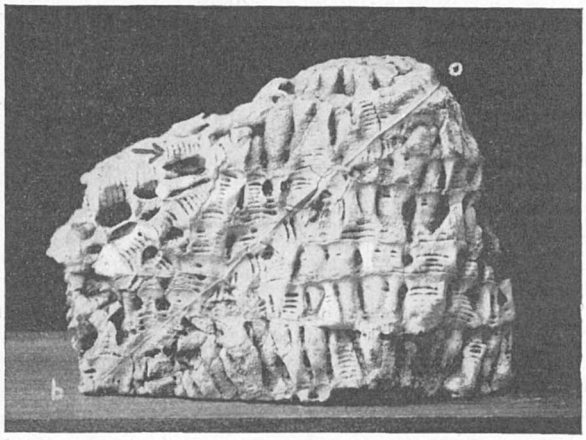

FIG. 1.—Weathered Magnesian Limestone, Carley Hill (natural size).

6 in. long and 2 in. thick, which was removed from the top of a "wall" of rock, this, at the base, is about 10 ft. thick, with a section, on the north side, of about 10 ft., and on the other side 20 ft., from the respective ground-levels. It is situated on the northern boundary of Old Southwick Quarry on Carley Hill, a part of Fulwell Hill.

Thicker bands are seen in this figure; the

FIG. 2.—Segregation banding in Cannon-ball Bed, Roker, 1901 (×1·5).

diagonal one, *b.o*, is what I term a "band of origin," from which the rods grew. Others, at right angles to the rods, are part of the original "honeycomb" structure. Apparently a few rods remain unaltered, but closer observation reveals the same zones, although not distinguishable in the photograph.

Fig. 2 represents part of a vertical surface on a southern face of the Cannon-ball Bed, where it juts

from the Roker Cliffs at Sunderland. Most of this surface is above the tide-mark. Many of the calcareous balls exposed in any part of this bed exhibit similar narrow concentric zones, which also are a rearrangement of the carbonate of lime in an orderly fashion after the formation of the spheres. A few years ago in Fulwell Hill Quarry I saw, on about the same horizon as the top of Carley Hill, already mentioned, a bed of such balls 2 in. to 3 in. in diameter, from which a few feet of Boulder Clay had been removed six years earlier. These also had the same concentric lines, but as yet I have had no opportunity of fixing a time-scale for the formation of zones shown in Fig. 1. I ought to state that a few microscopical examinations of unweathered specimens revealed no such lines across the rod structure. The two forms of weathering are probably due to the same physical change. The second one, when I saw it in 1901, I supposed was due to segregation, and therefore I have since then called it segregation banding, but a better title is possible. Similar zonings of carbonate of lime have been produced by osmotic action by Prof. S. Leduc, of Nantes, and are shown on p. 84 of his "La Biologie Synthétique" (A. Poinet, Paris). Much the same thing is now known as Liesegang's rings, but who can claim priority I do not know. Except for a considerable difference in width of the interspaces they closely resemble the zones in weathered mortar due to rearrangement of carbonate of lime.

GEORGE ABBOTT.

2 Rusthall Park, Tunbridge Wells,
December 30, 1916.

Tertiary Igneous Rocks of the Pyrenees.

THE review of the treatise of Beyschlag, Vogt, and Krusch in NATURE of August 3, 1916, gives prominence to their mention of supposed absence of Tertiary igneous rocks. Yet even their pages figure grey-copper veins of Los Arcos cutting Tertiary beside ophite and granite intrusions. The latest official map of a Pyrenean district (Orthez) figures the ophite veins cutting uppermost Cretaceous, which I have insisted on during thirty years. In that time I have succeeded in securing by fossil evidence the recognition of the Cambrian of the map of 1890 as Hippurite Cretaceous, the "Silurian" slates of Lourdes as Middle Cretaceous, and the Scolithia beds of San Sebastian as Nummulitic Eocene. The erroneous classification led to the conception of the entire Pyrenees as rolled from the Sierra Nevada in such confusion and reversal as forbid attention to local and detailed observation, in the progressive correction of the map of Dufrénoy.

Yet even in Cornwall the excellent version of French methods supplied by an eminently practical miner has promoted accurate observation, and even Suess has returned, in his latest pages, to the principle of direction. As a hopeful science, apart from literary speculation, geology must aim at verifiable measurements and fossil confirmation. As example, I may quote my latest revision of the cluster of interior basins between Pamplona and Bayonne, which present floors of the plain Cretaceous border, now cited as exposures of that plain beneath a shovelled Palæozoic mass. With accurate mining plans, I trace their Cretaceous filling, in places, to the highest surrounding summits, and its successive beds as distinctly synclinal in disposition. Exceptional points of dislocation and reversal prove to accompany those local faults attested in mining work, abounding specially on the depressions followed by the high roads of the tourist's automobile. The Tertiary age of much of the ophite and granite of the Pyrenees has been my main contention since my first map of 1881, confirmed in both France and Spain, and affording a fresh clue from the most neglected portion of the chain. The latest observations in both Alps and Andes led Suess himself to rehabilitate the importance of igneous intrusion, and its recognition in connection with mining and orogenics has seemed to me of supreme utility in practical geology.

P. W. STUART-MENTEATH.

Ciboure, January 20.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

THE sixty-ninth regular annual meeting of the American Association for the Advancement of Science was held in New York City on December 26–30, 1916, under the presidency of Dr. C. R. Van Hise, of the University of Wisconsin.

The headquarters of the meeting was Columbia University, but, with the twelve sections of the association and the fifty-two national societies of restricted scope affiliated with the association at this meeting, the large lecture-rooms of Columbia University were insufficient, and meetings were also held in the American Museum of Natural History, in Barnard College, in the College of the City of New York, in the Cornell Medical College, in the College of Physicians and Surgeons, and in the Union Theological Seminary. The association, while holding annual meetings, is making especial effort to have every fourth meeting unite all the scientific societies of the United States, and this meeting at New York was the first of these four-year meetings. The second will probably be held at Chicago in 1920.

The attendance was larger than it has ever been in the history of the association. More than two thousand registered at the association headquarters, and it is estimated that above a thousand more were in attendance at the meetings held in other parts of the city.

The address of the retiring president, Dr. W. W. Campbell, of the Lick Observatory, University of California, on "The Nebulæ," was delivered on December 27 in the large lecture-hall of the American Museum of Natural History. The address was followed by a reception given by the trustees of the museum, and the guests were received by Mrs. H. F. Osborn and by Mr. J. H. Choate, former United States Ambassador to London.

During the week presidential addresses before the different sections were given as follows:—

Prof. W. A. Setchell, of the University of California, before Section G, on "The Geographic Distribution of Marine Algæ." This address was followed by a symposium on the relations of chemistry to botany.

Prof. E. Davenport, dean of the College of Agriculture of the University of Illinois, before Section M, on "The Outlook for Agricultural Science." The address was followed by a discussion on "The Adjustment of Science to Practice in Agriculture."

Dr. G. F. Kunz, before Section I, on "Scientific Efficiency and Industrial Museums: Our Safeguard in Peace and War."

Prof. W. McPherson, of the Ohio State University, before Section C, on "Asymmetric Syntheses and their Bearing upon the Doctrine of Vitalism."

Prof. E. P. Cubberly, of Stanford University, before Section L, on "Some Obstacles in Educational Programme."

Prof. Lillian J. Martin, of Stanford University, on "Personality as Revealed by the Content of Images."

Mr. B. J. Arnold, of Chicago, before Section E, on "The Inter-relationship of Engineering and Pure Science."

During the week two public lectures, complimentary to the citizens of New York, were held. The first was by Dr. Simon Flexner, director of the scientific laboratories of the Rockefeller Institute for Medical Research, on "Infantile Paralysis and the Public Health." The second was given by Prof. A. A. Noyes, of the Massachusetts Institute of Technology, on "Nitrogen and Preparedness."

A number of important symposia were held in addition to those mentioned in connection with two of the vice-presidential addresses. Section K (physiology and experimental medicine) and the American Society of Bacteriologists held a symposium on "Cancer and its Control." The papers presented at this symposium were as follows:—

Prof. G. N. Calkins, of Columbia University, on "The Stimulating Effects of Protoplasmic Substances on Cell Division."

Prof. Leo Loeb, of the Washington University Medical School, on "Tissue Growth and Tumour Growth."

Dr. J. C. Bloodgood, of Johns Hopkins University, on "Cancer in the Human Being."

Prof. James Ewing, of the Cornell Medical School, on "Radium and Cancer."

Mr. C. E. Lakeman, of the American Society for the Control of Cancer, on "Past and Present Efforts to Control Cancer through the Education of the Public."

A conference on the metric system was held under the auspices of Section I, at which delegates from the National Wholesale Grocers' Association, the American Institute of Mining Engineers, the American Pharmaceutical Association, the American Institute of Electrical Engineers, the American Chemical Society, the National Wholesale Druggists' Association, the National Association of Retail Druggists, the Philadelphia Bourse, the Philadelphia Commercial Museum, and the American Institute of Chemical Engineers were in attendance. The council of the American Association for the Advancement of Science, at its final session on December 29, passed a resolution urging the general adoption of the metric system in the United States. The association has always favoured this move, and has passed similar resolutions at previous meetings.

A symposium on "The Structure of Matter" was held at a joint meeting of Sections B and C, the American Physical Society, and the American Chemical Society, in which Prof. R. A. Millikan, of the University of Chicago, Prof. G. N. Lewis, of the University of Chicago, Prof. R. W. Wood, of Johns Hopkins University, and Prof. W. B. Harkins, of the University of Chicago, were the principal speakers.

A symposium on "Biology and the National Existence" was held by Section F and the American Society of Naturalists, the principal speakers being Dr. S. Paton, of Princeton University, Mr. W. J. Spillman, of the U.S. Department of Agriculture, Prof. J. Loeb, of Columbia University, and Prof. E. G. Conklin, of Princeton University.

The American Genetic Association held meetings throughout the week, joining the American Association for the Advancement of Science for the first time; as also did the newly organised Ecological Society of America.

Another important series of meetings was held by the newly founded Federation of American Societies for Experimental Biology, formed by the Physiological Society, the Society of Biological Chemists, the Society for Pharmacology and Experimental Therapeutics, and the Society for Experimental Pathology.

The principal social events of the week, apart from the opening reception at the American Museum of Natural History, included a smoker at the Aquarium, given by the New York Zoological Society, and a reception by the United Engineering Societies in their beautiful clubhouse. There were many dinners, including an especially interesting one given in honour of Prof. E. B. Wilson, of Columbia University, by his former students.

The Committee of One Hundred on Scientific Research held an important meeting on the first afternoon, at which reports from a large number of sub-committees having charge of special aspects of scientific research questions were presented.

The most important action taken by the council of the association was to authorise a thorough revision of the constitution of the association, in the hope of increasing the efficiency of the association and to permit possibly more intimate relationships with the national scientific societies of specific scope.

The general committee, at its meeting on the final evening, accepted an invitation to meet at Pittsburgh in the winter of 1917–18, and elected the following officers:—

President: Prof. T. W. Richards, of Harvard University. *Presidents of Sections:* B, Dr. W. J. Humphreys, U.S. Weather Bureau; C, Prof. W. A. Noyes, University of Illinois; E, Prof. G. H. Perkins, University of Vermont; F, Prof. Herbert Osborn, Ohio State University; G, Dr. B. E. Livingston, Johns Hopkins University; H, Prof. E. B. Titchener, Cornell University; I, Mr. G. W. Perkins, New York City; K, Dr. C. E. A. Winslow, Yale University; L, Prof. E. F. Buchner, Baltimore; M, Prof. H. J. Waters, University of Kansas. *Secretary of Council:* Prof. W. V. Bingham, University of Pittsburgh. *General Secretary:* Prof. J. McK. Cattell, Colum-

bia University. *Secretaries of Sections:* B, Prof. George W. Stewart, State University of Iowa; C, Prof. J. Kendall, Columbia University; E, Prof. R. T. Chamberlin, Chicago; K, Dr. A. J. Goldfarb, New York.

RESEARCH IN TIMBER.

IN an address[1] to the Timber Trade Federation, delivered in October last, Prof. Percy Groom showed that the lack of co-operation in the past between technical science and the timber trade of this country had resulted in the timber resources of the Colonies and India not being efficiently utilised. The British Empire includes within its bounds a larger number and wider range of timbers than any other State; but many of these are imperfectly known, and on that account not in commercial use. Prof. Groom instanced many examples of the need for scientific research in timber. Wood-pulp, the import of which into the United Kingdom was valued at 5,500,000*l.* in 1913, is obtained at present mainly from spruce growing in foreign countries. In all probability it could be manufactured as cheaply from the soft woods, valueless as timber, which grow abundantly in the forests of our tropical possessions; and an investigation into this problem is most desirable. The hard woods of the tropics, owing to the loose nomenclature and wrong naming of many species, are less sought for than they deserve by architects, railway companies, and other large consumers of strong durable wood. The African mahoganies, for example, comprise a large series of different woods, varying widely in colour, hardness, and other qualities; and the identification and standardisation of these and other tropical woods should be the subject of prolonged scientific investigation. Some woods of great merit show defects in ordinary use which might be remedied by experiments in the laboratory, an interesting example being the Indo-Malayan Yang wood[2] (Dipterocarpus sp.), which had been introduced into England as a substitute for teak, but was found to warp badly and exude a resin, injuring its utility and appearance. Experiments carried out at the Imperial Institute resulted in the discovery of a simple cure for these defects, and the wood has been reinstated into favour.

Prof. Groom referred to a promising line of investigation, the economic utilisation of waste products which, in the form of slabs, shavings, and sawdust, are produced in great quantity in all conversion of wood. Every particle of wood is either a source of power, as when used for fuel, or can be transformed into a variety of valuable substances, as in the manufacture of explosives like cordite and acetone; of antiseptics, as creosote and carbolic acid; of alcohol, acetic acid, celluloid, collodion, artificial silk, etc. The chemical utilisation of wood lends itself especially to co-operative efforts in large towns; and some improved method of distillation may solve the problems of dealing profitably with coppice-woods in England, and with forests in the tropics which consist mainly of trees producing unmarketable timbers.

Another important problem, not yet attacked in this country, is the economical application of preservatives and antiseptics to mining timber, the life of which in the pits might in many cases be prolonged from three to thirteen years, if recent experiments in the United States are to be trusted. In any case, there is a possibility of a large saving in the cost of raising coal by improved sanitation and appropriate treatment of wood in mines.[3]

As a practical scheme for linking up technical science with the timber trade and its dependent industries in this country, Prof. Groom advocates the establishment of an Imperial Timber Bureau in London, which would be in close touch with the Colonies and Dominions. It would supply technical advice, conduct investigations, and diffuse information amongst the trades and professions that handle wood. To the bureau would be attached an institute with timber, chemical, physical, engineering, and fuel laboratories, as well as workshops. Though not mentioned by Prof. Groom, it is almost precisely on these lines that investigation in timber on a large scale has been successfully carried on for some time by the Products Branch of the United States Forest Service.[4] Some account of the working of this department will be of interest. It consists of two sections, the Office of Wood Utilisation at Chicago, and the Forest Products Laboratory at Madison.

The Chicago office serves mainly as a bureau for the collection of information and statistics of production, consumption, utilisation, etc.; but it also deals with problems not requiring the aid of a laboratory; for example, by inducing manufacturers to undertake experiments of various kinds. This office publishes reports on the wood-using industries in each State, which are compiled with the aid of owners of timber, merchants, manufacturers, railway companies, and other consumers of wood, including certain Government departments. Much has also been done to eliminate waste by this office suggesting possible uses for material that had formerly been burnt to get it out of the way. Mr. Burdon states that the economic value of co-operation between the wood-using industries in the United States and the Forest Service Utilisation Office cannot be over-estimated, as the confidence reposed in the latter by the timber trade is remarkable.

The Forest Products Laboratory at Madison is staffed and equipped by the Forest Service in co-operation with the University of Wisconsin, which provided the buildings at a cost of 55,000 dollars in 1910. It is planned for research work on a semi-commercial scale, and has a large

[1] *Timber Trades Journal*, October 7, pp. 565–71.
[2] Percy Groom, "Shrinkage, Swelling, and Warping of Cross-grained Woods," Ann. Applied Biology, vol. iii., No. 1, June, 1916.
[3] Percy Groom, "Pit Timber and its Preservation," Trans. Inst. Mining Engineers, vol. li., part ii., pp. 190–203.
[4] See U.S. Dept. Agric. "Review of Forest Service Investigations," vol. i., pp. 17–28 (1913); and E. R. Burdon in Journ. R. Soc. Arts, vol. lxi., pp. 438–446 (1913).

storage yard connected with the main railway by a switch line. There are sheds and buildings for natural and artificial seasoning of timber, a saw-mill, a carpenter's shop, and eight laboratories, devised for technical research in timber-testing, the physical properties of wood, pathology, wood-preservation, wood-distillation, paper and pulp manufacture, and engineering and chemistry problems connected with timber. The research work undertaken is all carefully planned with the express object of obtaining results which will directly benefit the timber merchant and consumer. The field covered in the general scheme laid down for research accordingly includes every important industry which derives its raw material from the forest.

The Forest Products Branch in the United States furnishes a model which might readily be adapted to our needs. The interests, however, of the timber trade, of the home consumer, and of British owners of woodlands must all be carefully considered, if a satisfactory general scheme is to be evolved. The Bureau of Information and Statistics would necessarily be in London. The laboratories and workshops could perhaps be established in connection with the university which took the greatest interest in the project.

NOTES.

LORD DEVONPORT, the Food Controller, has issued a statement pointing out the urgent need for economy in food, and the necessity for some curtailment of the nation's food consumption. The three most important staples of daily consumption are bread, meat, and sugar, and forethought for the sustenance of the population requires a decision as to whether compulsion is necessary to ensure an equitable distribution and conservation of available supplies. Compulsory rationing to a fixed quantity per head involves a very elaborate machinery, which in itself absorbs labour, and for that reason alone ought to be avoided unless absolutely necessary. Therefore, having carefully weighed the advantages and disadvantages, the Food Controller has come to the conclusion that a voluntary system is preferable until further experience is gained, and meanwhile to trust to the nation's instinct of self-discipline. The following allowance is based on the average weekly consumption of each of the commodities named which should be permitted to each person. After consideration of available stocks and probable means of future supplies, the situation requires that heads of families should endeavour to limit themselves to the weekly purchase for each person comprising the household of the following quantities per head per week:—Bread, 4 lb. (or its equivalent in flour, 3 lb. for bread-making); meat, 2½ lb.; sugar, ¾ lb. Although these quantities will form the basis of the dietary scale, they will naturally be supplemented by other food products. The nation is placed upon its honour to observe these conditions. The effect upon consumption will reveal itself through the statistical returns available to the Food Controller. Meanwhile, to meet the contingency that rationing may become necessary, the machinery to bring such a system into operation is being organised, so that if and when required it may be ready. It is hoped that a patriotic endeavour will be made by everyone to limit consumption wherever possible to below the standard indicated, and by so doing render rationing unnecessary.

THE report of a committee of the Royal Society, made at the request of the President of the Board of Trade, on the food supply of the United Kingdom has just been issued. It is divided into three parts, the first dealing with food supply in the period 1909–13, the second with food supply in 1916, and the third with possible methods of economising the available food supply. The recommendations respecting economies are as follow:—(1) The possibility of a better recovery of flour in milling; (2) the possibility of more economical meat production; (3) the possible increase in the national food supply which might result from a general practice of making cheese in place of butter; (4) a consideration of the economy of food which might be effected by the prohibition of brewing.

THE formation of the new Air Board is authorised by an Order in Council published in the *London Gazette* of Tuesday last. The composition of the board is as follows:—President, Viscount Cowdray; Parliamentary Secretary, Major J. L. Baird; Fifth Sea Lord of the Admiralty, Commodore G. Paine; Director-General of Military Aeronautics, Lieut.-General Sir David Henderson; Controller of Aeronautical Supplies, William Weir; Controller of Petrol Engines, Percy Martin; secretary, Sir Paul Harvey; assistant secretary, H. W. W. McAnally; private secretary to the Parliamentary Secretary, C. G. Evans.

AT the scientific meeting of the Royal Dublin Society on January 23, Lord Rathdonnell, president, in the chair, the Boyle medal of the society was presented to Prof. H. H. Dixon in recognition of his distinguished work for botanical science, and particularly his investigations on transpiration and the ascent of sap in plants.

PROF. R. SAUNDBY has been appointed to deliver the Harveian Oration to the Royal College of Physicians of London for the present year. Dr. E. S. Reynolds is to be the Bradshaw Lecturer. Dr. T. M. Legge will be the Milroy Lecturer in 1918.

WE regret to notice the death, on Sunday last, February 4, at the age of seventy-three years, of Mr. C. Owen Waterhouse, formerly assistant keeper of the British Museum (Natural History).

BY the death of Mr. John Tebbutt, of Windsor, N.S.W., briefly announced in our issue of last week, disappears, at the ripe age of eighty-four, one of the few remaining links that connect the astronomy of to-day with the older form that Airy and his school recognised and practised. The late Mr. Tebbutt, as a loyal member of that school, worked hard to record positions, to deduce orbits, and to study planetary markings. Inadequate instruments did not rob him of the delight of industrious occupation in his selected science, but he did a far greater work than discover comets and painfully determine their position by imperfect means. In a nascent colony in which the conditions of life were adverse to scientific study, and where the stimulus of sympathetic companionship was utterly wanting, he worthily upheld the claims of intellectual study, and struggled manfully in the pursuit of research. He was of the highest type of amateur, one who followed his own inclinations with ardour and enjoyment, never tiring and never changing; he had his reward in well-doing. He observed Donati's comet, nearly fifty years ago, and among his latest observations those of comets still found a place. He was the discoverer of the great comet of 1861, following it with a sextant, and though such an instrument was utterly inadequate for the purpose, as the writer of this note can unfortunately testify, for it fell to him to reduce the observations, yet the Observatory at Melbourne was little better off,

for the assistant, Mr. White, had no other means. Mr. Tebbutt's example has, no doubt, done much to stimulate progress in the colony, and that his silent, steady work impressed his fellows is shown by the fact that later he was offered the post of Government astronomer. This appointment was refused, and no doubt wisely, for by that time he had improved his equipment, acquiring first a 4½-in. Cooke, and afterwards an 8-in. refractor by Grubb, and could push his researches in the direction that best pleased himself.

THE *Revue Philosophique* for January announces the death, on December 9, of Prof. T. A. Ribot, the well-known psychologist and philosopher. Prof. Ribot was born at Guingamp in 1839, and during his long life did much, both by lecturing and writing, to further the study of psychology. In 1888 he was appointed professor of experimental psychology at the College of France. He made contributions to many psychological problems, but probably his monographs on some mental diseases, namely, "Les Maladies de la mémoire, de la volonté and de la personnalité," have had the widest circulation of all his works. In his "Essai sur les passions" and in "Problèmes de psychologie affective" he directed attention to the importance of the emotions in the life of the individual, and thus helped to modify the exaggerated belief of many writers in the dominance of the intellectual processes. His interest in English thought is shown by his work, "La Psychologie anglaise contemporaine," and by his translation of Herbert Spencer's "Principles of Psychology." He also edited the *Revue Philosophique* from the beginning of that journal.

Engineering for February 2 records the death of Mr. George Andrew Hobson, which occurred on January 25 in his sixty-third year. Mr. Hobson was for many years a partner with Sir Douglas Fox and Sir Francis Fox, and played an important part in the extensive work which the firm carried out, especially in South Africa. Perhaps the best example of his work is the bridge spanning the Zambezi River near the Victoria Falls. The southern part of the constructional work involved in the completion of the Great Central Railway was carried out by his firm, and in this, as well as in connection with the tube railways of London, Mr. Hobson took an active share. He was a member of the Institution of Civil Engineers, and was awarded a gold medal for each of the two papers he contributed to the Transactions. It is of interest to note that his chief enjoyment was found in the depths of the country, alone with Nature, studying bird-life. His widow and daughter have the deep sympathy of a large circle of professional and social friends.

THE death is announced, in his fifty-first year, of Mr. Henry Gordon Stott, a former president of the American Institute of Electrical Engineers. Mr. Stott was a native of the Orkneys, and was educated at the Watson Collegiate School, Edinburgh, and the College of Arts and Sciences, Glasgow. After doing various professional work in England and Spain, he went to America in 1891 to do construction work for the Buffalo Light and Power Co. Since 1901 he had been superintendent of the motive power of the New York street railways. He was the author of many important papers on electrical engineering.

THE new institute at Potsdam for research in genetics, connected with the Landwirthschaftliche Hochschule of Berlin, was opened in April, 1916. Prof. Erwin Baur is in residence as director, combining this duty with medical work under the German Admiralty.

CAPT. AMUNDSEN, the Norwegian explorer, who proposes to endeavour to reach the North Pole by aeroplane, is on his way to Norway from America to complete his plans. The ship in which he will make the first part of the journey is to be launched at Christiania next March, and Capt. Amundsen expects to start his scientific expedition about the summer of next year. He hopes eventually to come into touch with Robert A. Bartlett, another explorer, who is going *via* Bering Strait.

AT the annual meeting of the Royal Microscopical Society, held on January 17, the following officers were elected for the year 1917:—*President,* E. Heron-Allen; *Vice-Presidents:* J. E. Barnard, A. Earland, R. G. Hebb, F. Shillington Scales; *Treasurer,* C. F. Hill; *Secretaries:* J. W. H. Eyre, D. J. Scourfield; *Ordinary Members of Council:* H. F. Angus, A. N. Disney, F. Martin Duncan, T. H. Hiscott, J. Milton Offord, R. Paulson, P. E. Radley, A. W. Sheppard, E. J. Sheppard, C. Singer, C. D. Soar, J. Wilson; *Librarian,* P. E. Radley; *Curator of Instruments,* C. Singer; *Curator of Slides,* E. J. Sheppard; *Editor of Journal,* R. G. Hebb.

IN connection with the Faraday Society there will be a general discussion on "The Training and Work of the Chemical Engineer" on Tuesday, March 6, at 8 p.m., in the rooms of the Chemical Society, Burlington House, W. Sir R. Hadfield, president of the society, will preside over the discussion, which will be opened by Sir G. Beilby. The following papers will be read:—"The Training of the Chemical Student for Work in the Factory," by Prof. F. G. Donnan; "The Training of the Works Chemist in Physics," by C. R. Darling; and "A Plea for the Forgotten Factor in Chemical Training," by W. R. Cooper.

A SPELL of cold weather has occurred over England during the last five weeks, and its principal characteristic has been its persistence. The cold has rarely been severe, and the absence of warmth during the daytime has been much more marked than the degree of cold at night. No temperature so high as 50° has occurred in London since January 3, and between January 13 and February 5 the thermometer did not rise to 40°, whilst after January 19 it had only exceeded 35° on three days. The maximum, or day, temperature has not once risen to the average since January 5. January started with very warm weather, the mean in London for the first three days being 50·5°, which is in precise agreement with the record high temperatures for the corresponding three days of 1916 and 12° above the normal. The mean temperature of the recording station of the Meteorological Office at South Kensington for January was 36·5°, which is 1·9° below the mean at Greenwich during the last sixty years, taken for comparison, as the Kensington records are for too short a period. The mean maximum, or day, temperature was 39·1°, which is 3·8° below the Greenwich average, whilst the mean minimum, or night, temperature was 34°, the same as the average. There has been no mean maximum for January so low since 1897, when it was 38·7° at Greenwich, and in 1895 it was 37·7°: in both these years the mean night temperature for January was below the freezing-point, being 29·5° in 1895, which is 4·5° lower than the present year, although the mean day temperature in 1895 was only 1·4° lower. January is normally the coldest winter month, but in 1916 it was the warmest winter month and February the coldest. January this winter had the mean day temperature 4° lower than December, but the night temperatures were the same. Snow has fallen with considerable frequency, and in places the fall has been

somewhat heavy. The ice has already afforded the pastime of skating, but it has not as yet become general, as in the more severe winters of 1890–91 and 1894–95.

THE council of the Association of Chambers of Commerce is, we learn from the *Times*, considering draft Bills designed to carry out reforms in our systems of weights and measures and of coinage, and should the council approve of them they will be submitted to the Chambers of Commerce throughout the country. If there proves to be general agreement the association's Bills will be introduced into Parliament. It is probable that a Bill for establishing a decimal coinage will have first attention, the Bill for introducing metric weights and measures not being pressed until the country has grown accustomed to a decimal coinage. It is suggested that the simplest means of making the change would be the adoption of the present florin, which is the tenth part of a sovereign, as the unit. The existing farthing would be replaced by a "cent," equal to the hundredth part of a florin, instead of a ninety-sixth part as now. In this connection it is worthy of note that Sir Edward Holden, at the meeting on January 26 of the London City and Midland Bank, of which he is chairman, expressed himself strongly in favour of the adoption by this country of the metric system. One of the hindrances to the extension of our foreign trade, he said, is the fact that we do not present our catalogues in foreign countries so advantageously as do other countries. If we are seeking to extend our trade to those countries where German influence has hitherto predominated we must at once begin to adopt the systems which are most easily comprehended by purchasers. The metric and decimal systems have been adopted by all European countries except Russia, and in that country they were, before the war, fast coming to the front. These systems are also used in South America and Japan. In fact, there are few countries which do not use them at the present time.

OWING to the special importance at the present time of establishing commercial connections on a firm basis between the Allied countries, the Russo-British Chamber of Commerce at Petrograd requests all British firms wishing to trade with Russia now or after the war to send their catalogues and price-lists (not fewer than ten copies) to the chamber, 4 Gorochovaia, Petrograd, Russia. The catalogues will be placed in the special library of the chamber, and will be distributed to Russian merchants interested in the development of their trade connections with England.

A CAVE known as the Tecchia d'Equi, in the district known as Lusigiana and situated between Spezia and Carrara, has long been explored for the prehistoric remains which it contained. Of these, an account is given by Dr. Carlo de Stefani in the *Atti dei Lincei*, xxv. (2), 3. Excavations were first made in this cave in 1909 by Mr. Podenzana, curator of the Spezia civic museum, and they have now been continued by the author with the aid of a small grant from the Italian Association for the Advancement of Science. Human remains have been found, but only in a very incomplete state, and these have been referred to about thirty subjects, mostly women and children. On the other hand, the grotto and Tecchia were principally inhabited by *Ursus spelaeus*, and, moreover, the fauna was essentially alpine in character. The Tecchia was a real "abri sous roche" in the Triassic limestones at the foot of a wild region of the Apuan Alps and at an altitude of 352 metres. In it was an opening leading into a spacious cave in which the remains in question have been found. Even in historic times the Tecchia has served as a human habitation.

NEOLITHIC implements have often been found in places remote from the source of origin of the rocks of which they are formed, and it appears definitely agreed that the giadeitic and nephritic minerals used in those implements found in many regions of Italy are of Alpine origin. In a note in the *Rendiconti del R. Istituto Lombardo* (xlix., 15) Rosa Bariola publishes interesting photomicrographs of rock sections made from implements found near Cagliari, in Sardinia. Three specimens were observed, one of giadeitite from Sant' Apparassi, near Cagliari, one a fragment of an axe from Lesbo, consisting of nephritite, and the third of a form of chlorite from Settimo, all these localities being a little to the east of Cagliari. There is good reason for thinking that no rocks of the same character occur in Sardinia, and it is uncertain whether such are found in Corsica.

ALL facts in regard to the life-history of that most remarkable bird, the Hoatzin (*Opisthocomus cristatus*), are most welcome. Hence we are glad to know that Father C. B. Dawson is making a careful study of this bird in its native haunts. The results so far obtained he gives us in his "Hand-list of the Birds of British Guiana," which has just reached us. Herein he remarks that the mother feeds the young as young pigeons are fed. That is to say, the method is the same, the young abstracting their food by thrusting the head down the mother's throat. But he makes no mention of the nature of the food thus obtained. This he will probably tell us later, as he remarks in this account that the food-plants of the adult are now being investigated. It would also seem that this bird is polygamous. Still further notes on the same theme, and covering different aspects of the life-history, are furnished by Mr. G. K. Cherrie in his "Contribution to the Ornithology of the Orinoco Region," published in the *Science Bulletin*, vol. ii., No. 6, of the Museum of the Brooklyn Institute of the Arts and Sciences. From this source we gather that the young Hoatzin is almost naked at birth and of a shiny jet-black colour, tinged with olive. Within a day or two the eyes are opened, and from that time forward it can only be approached with the most extreme caution, as it drops from the nest into the water on the slightest alarm. He also gives some valuable facts in regard to its nest-building and the extended period over which the breeding is carried.

A NEW species of digging-wasp, captured in the Forest of Dean so far back as 1897, is described by Mr. R. C. Perkins in the *Entomologists' Monthly Magazine* for January. Though long puzzled by his capture, Mr. Perkins only recently set himself seriously to the task of its identification. On bringing it to the British Museum he found that Mr. K. G. Blair had also taken this insect in 1912 at Stanmore, Middlesex. His examples, a male and female, were bred from cocoons taken from a dead thistle-stem in the previous year, but though he preserved his specimens he did not attempt to identify them. The description of the insect is given now by Mr. Perkins, who names it *Pompilus cardui*.

IN his presidential address before Section C of the South African Association for the Advancement of Science Mr. I. B. Pole Evans, chief of the division of botany in the Department of Agriculture, Pretoria, gave an interesting sketch of the rise, growth, and development of mycology in South Africa. The earlier part of the address is occupied with an account of the contributions of various botanists and travellers from Persoon, "the father of the science of mycology," who collected in 1755, to the present day. A por-

tion of the address is devoted to a brief survey of the cereal rust fungi, a subject to which Mr. Pole Evans has contributed much valuable work in the Transvaal. Wheat, oats, rye, and barley are all attacked by the black rust, *Puccinia graminis*, Pers., and the first three cereals are also each attacked by a second rust fungus. Maize is also subject to two rusts, *P. maydis*, Bereng., and *P. sorghi*, Schw. It will be remembered that Mr. Pole Evans discovered that *Oxalis corniculata* is the alternative host of *P. maydis* in South Africa. For the other Puccinias no alternative host is yet known, and there are no barberry bushes in the country. *P. graminis* therefore exists without its æcidial host, and as the over-wintering of the uredo, or spring spores, does not appear to be entirely responsible for the sudden outbreaks of disease, the history of the telentospores in South Africa is an important problem deserving of careful research.

THE *Archivos do Jardim botanico do Rio de Janeiro*, vol. i., fac. i., which has recently reached us, contains an account of new or little-known Amazonian plants by A. Ducke, illustrated by nineteen plates. The volume also contains a well-illustrated account of the remarkable genus of Cactaceæ, Rhipsalis, by A. Löfgren. Among the new plants figured by Ducke are two new species of the Cycadean genus Zamia; one, *Z. Lecointei*, was found near Obidos, and is the first Cycad to be found in the province of Para. Another, from the south-east of Colombia, may be the same species as that found by Spruce many years ago in Uaupes. Ducke concludes his paper with descriptions and notes of species of the Solonaceous genera Ectozoma and Marckea, the habitats of which are the nests of ants, either of the genus Azteca or Camponotus.

A CAREFUL account of the different trees which have passed under the name of Brazil wood, and afford the valuable red dye, is given in Kew Bulletin No. 9. The Brazil wood of the fourteenth and fifteenth centuries came from the East, and was no doubt derived from *Caesalpinia sappan*. It has recently been replaced largely by the West African camwood, *Baphia nitida*. Some eight trees have at different times been known under the names Brazil or Braziletto, and in addition to those mentioned, namely, *C. echinata* from Brazil, *C. brasiliensis*, *C. bahamensis*, and *C. bicolor* from Peru and Colombia. Then there are *Peltophorum brasiliense* from Jamaica and Cuba, a very useful timber tree, and *Haematoxylon Brasiletto*, which is a native of Colombia, Venezuela, and Central America, and may prove to be a valuable article of commerce in Colombia. Finally, there is the well-known logwood, *Haematoxylon campechianum*, a native of Yucatan and British Honduras, which has been largely planted in the West Indian islands and elsewhere. A long account of the early traffic in this wood is given, and the article is illustrated with figures of the pods of all these valuable leguminous trees.

IN *American Forestry* for December a warning note is uttered as to the grave danger which threatens the extremely valuable white and five-leaved pines of New England and Canada from the spread of the "pine blister disease," which is making alarming headway, being spread by infected currant and gooseberry bushes, both wild and cultivated. In south-western Maine 85 per cent. of the trees are infected, and of these 50 per cent. are either dead or doomed. Profiting by the devastation caused by the chestnut blight, which was neglected on its first appearance, legislation of a drastic character is being framed to cope with the menace. In the same issue the Hon. David Houston justifies the decision of Congress to take and keep control of all forest land for the regulation of timber production and watershed protection, and to this end large areas of forested land are now being purchased by the Government.

DR. F. DU CANE GODMAN has presented to the British Museum (Nat. Hist.) some fragments of a second skull of *Eoanthropus dawsoni*, which were found by the late Mr. Charles Dawson in 1915 in the Piltdown gravel of a new locality. The specimens will be described by Dr. Smith Woodward in his fourth paper on Piltdown Man, which is to be read at the next ordinary meeting of the Geological Society on February 28.

DR. CHARLES D. WALCOTT has published a third part of his valuable and exhaustive work on Cambrian Trilobites, chiefly from North America and China (Smithsonian Miscellaneous Collections, vol. lxiv., No. 5). It is illustrated in the usual excellent manner with twenty-three plates, and a glance over the figures enables one to realise the extraordinary diversity of the Trilobites in the very early fauna to which the species represented belong. The genus Corynexochus is of special interest to the geologist in Canada, as affording a means of correlating the Lower Cambrian rocks in the St. Lawrence-Newfoundland area with those of Mount Whyte, in the Canadian Rocky Mountains.

THE need for extreme caution in generalisations in geography, especially in human geography, may well be insisted on, and forms the subject of a paper by Mr. G. G. Chisholm in the *Scottish Geographical Magazine*, November, 1916 (vol. xxxii., p. 507). Mr. Chisholm's paper is a closely reasoned argument illustrated by generalisations, which he feels merit criticism, quoted from Ratzel or other more modern geographical writers. He draws an important distinction between influences which act independently of man's will, and others which do not. The latter are affected by so many unknowable circumstances that they can never be stated except in approximate terms. The failure to distinguish these two classes of laws has been a most fruitful source of confusion in geography. Secondly, Mr. Chisholm reminds his readers that the value of geographical conditions varies with the circumstances of the time, and, thirdly, that statements in human geography, when the human will is concerned, are all the more likely to approach the universality of an absolute law the more imperious is the urgency that leads to the behaviour on the part of man that is taken for granted in the statement. Lastly, he dwells on the danger of laying too great stress on any one cause affecting human development to the neglect of others.

THE abnormal ice conditions around Spitsbergen in 1915 and 1916 are discussed by M. Adolf Hoel, of the University of Christiania, in an article in *La Géographie*, vol. xxxi., No. 3. The question is not only of interest in relation to the weather experienced in north-western Europe in these years, but of great importance in respect of the growing economic development of Spitsbergen. In the summer of 1915 strong easterly winds caused the ice to drift round South Cape and block the west coast until August. Vessels had some difficulty in entering and leaving Icefjord. Late in August more ice arrived by the same route and caused difficulties in September. This is very unusual. On the other hand, the same easterly winds caused the east coast of Spitsbergen to be more open than it has been any year since 1898. In the middle of August a vessel had no difficulty in traversing Hinlopen Strait from the north, and reached the extreme east of North-East Land. Further east, towards Hope Island and Franz Josef Land, the sea was singularly clear

of ice. This shows that a year such as 1915 might hinder economic development in the west, but would most certainly favour it in the east. In the summer of 1916 these abnormal conditions to some extent were repeated, and ice was troublesome on the west coast until early in September. It should, however, be pointed out that, despite this, the coal-mines in Advent Bay exported 30,000 tons of coal in 1916. M. Hoel also directs attention to the advance of the glaciers in North-East Land since 1898.

IN a valuable paper which appears in the January number of the Journal of the Franklin Institute, Mr. Ralph Brown, of Cornell University, summarises the results which have been obtained during recent experiments on the magnetic properties of iron and nickel under rapidly alternating magnetic fields. The belief that, at the frequencies in common use in power transmission, the permeability of iron was much less than in steady fields now appears to be unjustified, the apparent diminution being due to the alternating fields never penetrating beneath a thin superficial layer of the iron. When, as in recent observations, this skin effect is allowed for, the permeability is found to retain its steady field value up to a frequency of a thousand per second. At a frequency of 10^5 it is, however, reduced to 500, at 10^7 to 200, at 10^9 to 50, at 10^{10} to 20, while at the frequency of light it is reduced to unity. The behaviour of nickel is like that of iron, except that its initial permeability is only 100.

MANY readers of NATURE will doubtless be interested to learn that the advertisement which appears in another column of a modern Elizabethan house which is to be let or sold refers to The Camp, Sunningdale, where Sir Joseph Hooker lived for upwards of a quarter of a century.

MESSRS. WITHERBY AND CO. have been appointed European agents for the "Journal of the Natural History Society of Siam."

OUR ASTRONOMICAL COLUMN.

THE LAKE OKECHOBEE METEORITE.—A stony meteorite which has received this title at the U.S. National Museum has been described by G. P. Merrill (Proc. U.S. Nat. Mus., vol. li., p. 525). It is of rather special interest from the unusual circumstances attending its discovery, having been brought up in a fishing-net some three-quarters of a mile from the shore of the lake from which it receives its name. There is no definite record of a fall in this neighbourhood, but the finder recalls a brilliant meteor which passed to the west of Ritta about thirteen years ago, and was accompanied by explosive sounds. The fragments secured weigh about 1100 grams, and appear to have come from a mass originally ten or twelve inches in diameter. Notwithstanding its long immersion, the stone is still firm and shows the characteristic thin lustreless black crust. The chondritic type of the stone is at once evident in thin sections under the microscope.

CLUSTER VARIABLES.—In the course of an investigation of variable stars in the cluster M5, Prof. S. I. Bailey has found eight stars which have light-curves showing peculiarities not hitherto recognised (Harvard Circular, 193). While the mean period of sixty-one variables of the ordinary cluster type in M5 is 0·547 day, that of the eight stars in question is 0·271 day, or about half the more usual period. Prof. Bailey suggests that such a star may be formed of two variables, each being of the ordinary cluster type, and having the usual period of about half a day, with alternating maxima. This hypothesis is supported by peculiarities in the form of the light-curves, which can be resolved into two curves of the usual type. Spectroscopic observations might provide further tests of this supposition. Prof. Bailey is of opinion that the uniformity of period of cluster variables must have some physical cause, which may separate them from other variables of short period. The mean period in ω Centauri is 0·549d.; in M3, 0·541d.; in M5, 0·547d.; and similar results have been found for other clusters. It is still an open question whether these stars are spectroscopic binaries; if an ordinary cluster variable is a binary, a double variable, on the above hypothesis, must be a system of four components.

UNITED STATES NAVAL OBSERVATORY.—The annual report of the superintendent of the U.S. Naval Observatory for the year ending June 30, 1916, is notable for the attention directed to the increasing demands on the observatory in connection with the submarine and aircraft services. New and improved methods and instruments for accurate and rapid navigational and plotting work have been devised, and instruction given to the *personnel* of the services. The policy of encouraging suggestions, and of making the necessary trials, is stated to have produced several new methods and instruments of value.

The regular programme of astronomical observations was continued without intermission throughout the year, and included numerous observations of the satellites of Saturn and Uranus. It is interesting to note that the American ephemeris for 1919, which is in the press, will include tables for computing the rising and setting of the sun and moon. A special publication referring to the total eclipse of the sun of June 8, 1918, visible in the United States, is in course of preparation.

INTERNATIONAL AND NATURAL LAW.[1]

THE idea of issuing photographic reproductions of the text of such works as can be said to have contributed either to the origin or to the growth of international law, together with English versions by competent scholars, and with introductions giving biographical details and pointing out the importance of the text and its place in the development of the science, is a most worthy conception, and the commencement of its execution is a timely reassurance to the fears of those who imagined that the Germans had made an end of international law. The photographed text obviates possible mistakes in reprint. At the same time provision is made for the rectification of original misprints: where earlier authors have been ill-served by their printers a revised text will accompany the photographed text. The full bibliographies will be appreciated, and the portraits of the authors are interesting. The volumes form handsome quartos, and the typography might almost satisfy the exacting requirements of an Aldo Manuzio.

(1) The introduction to Vattel, by Prof. Albert de Lapradelle, sketches the life of the author, examines the character of his work and the grounds of its success, and assesses its value. A sustained discussion of Vattel's position was very desirable, and Prof. de Lapradelle has successfully met the need; the only weakness of his monograph is occasional repetition, a fault of form inevitably arising from his division of

[1] "The Classics of International Law." Edited by James Brown Scott, President of the American Institute of International Law. (1) "Le Droit des Gens." By E. Vattel. Text (2 vols.), and Translation by C. G. Fenwick (1 vol.). (2) "De Iure Naturæ et Gentium Dissertationes." By Samuel Rachel, edited by Ludwig von Bar (1 vol.); with Translation by J. Pawley Bate (1 vol.). (Carnegie Institution of Washington, 1916.)

the matter, but readily pardoned. It does seem surprising—and surprise has not infrequently passed into resentment—that Vattel, with a mind on a much lower plane than the master-mind of Grotius, should yet have "certainly won a success equal to that of Grotius, perhaps even greater." Vattel himself would probably be as much surprised as his most caustic critic, for he was very humble indeed in his claims and expectations. Yet Vattel had the merit, and therefore is entitled to the reward, of clear statement and of popular presentment; he was fortunate in being more accessible through his language; if both sides could cite him for their opposing views, the fact stands to the credit of his fairness and candour; and if he translated Wolff's ideas into intelligible form, it was at least a good service to the science. But Prof. de Lapradelle takes pains to demonstrate that Vattel was considerably more than a populariser of Grotius and Wolff—that he broke away from them on important points, and that, even when he followed them, he improved upon them. For example:—"While Grotius and Wolff still held to the patrimonial character of the State, Vattel was the first of the writers on the Law of Nations to have a clear and concise, systematic, and co-ordinated conception of the modern State as a Nation truly free, founded on the adherence of its members, and exempt from tyranny, just as he was among the first, in the realm of municipal law, to conceive of the modern State, not as a maintainer of order, but as a promoter of happiness. This whole section of the work is truly that of a master." Again, on certain aspects of arbitration, on the interpretation of treaties, on the difficult question of diplomatic immunities, the work of Vattel cannot be ignored. And, not to cite further examples or to go into details, "without Wolff's help Vattel clearly excels Grotius in his formulation of the laws of war and of neutrality." "What Vattel lacks is a legal philosophy." Granted: the distinction between perfect and imperfect rights, though utilisable so far, yields only an apparent reconciliation of the sovereignty of the State with the subjection of the State to law. Still, is Vattel the only writer that has not managed to solve the problem?

"At a time when diplomacy recognised no other rules than caprice or interest Vattel mapped out its boundaries. At a time when the sovereignty of the State was still confused with the sovereignty of princes he formulated the rights of the Nation. Before the great events of 1776 and 1789 occurred, he had written an International Law, based on the principles of public law, which two Revolutions, the American and the French, were to make effective. . . . Vattel's 'Law of Nations' is international law based on the principles of 1789—the complement of the 'Contrat Social' of Rousseau, the projection on the plane of the Law of Nations of the great principles of legal individualism. That is what makes Vattel's work important, what accounts for his success, characterises his influence, and eventually likewise measures his shortcomings. Grotius had written the international law of absolutism; Vattel has written the international law of political liberty."

(2) Rachel's dissertations appear to have fallen into abeyance: "the original text is exceedingly difficult to procure." Dr. Pawley Bate furnishes an accurate and spirited rendering—the first English translation of the work. The introduction, by the late eminent Göttingen professor, Ludwig von Bar, gives an interesting sketch of the strenuous life of Rachel, and a brief but pointed summary of the contents of the dissertations. Dr. Brown Scott, the general editor, states concisely the grounds for including the work in this series:—"Rachel's Dissertations were in the nature of a protest against the school of natural law, of which Pufendorf was the very head and front, and contributed in no small measure to the conception of International Law as a system of positive law, and Rachel, by virtue of this work, occupies an honourable rank as a member or as a forerunner of the positive school." "To attack this [Pufendorf's] doctrine, which favoured arbitrariness, and based the Law of Nations solely upon the principles of Natural Law established by *a priori* reasoning, and at the same time to show that by the side of the *ius naturae* there exists a positive Law of Nations—this," says von Bar, "was a signal service." Rachel's claim to originality, like Vattel's, has been questioned; "writers of the late seventeenth and early eighteenth centuries, who dealt with his treatise 'De Iure Naturæ et Gentium,'" says Nys, "have remarked that its fundamental ideas were borrowed from that man of immense talent, Hermann Conring," whose lectures on public law he attended at the University of Helmstedt. Conring apparently needed an interpreter as much as Wolff did; but, however much Rachel may have been a populariser, or even (if you will) a plagiarist, he was undoubtedly a vigorous and sagacious man, capable of strong independent work, and Nys's report may be left over for future investigation. It is interesting to note that Rachel deals at considerable length with the views of some English jurists and theologians who "have devoted themselves more than others to the systematic analysis of Natural Law"—John Selden first and best, then Sharrock, Herbert of Cherbury, Cumberland, and, last, Hobbes "and his worse than barbarous philosophy." Whatever deductions may fall to be made, Rachel is still a strong link in the chain of development, and the Carnegie Institution has done good service in rediscovering him and re-introducing him to students of International Law.

FORTHCOMING BOOKS OF SCIENCE.

AGRICULTURE AND HORTICULTURE.

Cambridge University Press.—Plants Poisonous to Live-stock, H. C. Long (Cambridge Agricultural Monographs). *Cassell and Co., Ltd.*—Garden First in Land Development, W. Webb; Gardening: a Complete Guide, H. H. Thomas; Potatoes and Root-crops; Tomatoes and Salads; Profitable Small Fruits; The Beginner's Gardening Book. *Chapman and Hall, Ltd.*—Dairy Cattle Feeding and Management, Profs. C. W. Parson and F. S. Putney. *Longmans and Co.*—A Handbook of Nature Study and Simple Agricultural Teaching for the Primary Schools of Burma, E. Thompstone. *John Murray.*—The Book of the Rothamsted Experiments, issued with the authority of the Lawes Agricultural Trust Committee, originally edited by A. D. Hall, a new and revised edition, edited by Dr. E. J. Russell, with illustrations.

ANTHROPOLOGY AND ARCHÆOLOGY.

Chatto and Windus.—A History of Babylonia and Assyria from Prehistoric Times to the Persian Conquest, Prof. L. W. King, in three volumes, illustrated; vol. iii., A History of Assyria from the Earliest Period until the Fall of Nineveh before the Medes, B.C. 606. *Longmans and Co.*—The Folk-element in Hindu Culture: a Contribution to Socio-religious Studies in Hindu-folk Institutions, Prof. Benoy Kumar Sarkar, assisted by H. K. Rakshit. *Macmillan and Co., Ltd.*—Community: a Sociological Study, Dr. R. M. Maciver; The Origin and Development of the Moral Ideas, Dr. E. Westermarck, vol. ii., new edition.

BIOLOGY.

Cambridge University Press.—Growth and Form, Prof. D'Arcy W. Thompson. *Cassell and Co., Ltd.*—An Introduction to Biology, and Other Papers, the

late A. D. Darbishire; Rockeries: How to Make and Plant Them, H. H. Thomas. *Chapman and Hall, Ltd.*—A Practical Entomology for Schools, E. D. Sanderson and Prof. L. M. Peairs. *Methuen and Co., Ltd.*—Secrets of Earth and Sea, Sir Ray Lankester, illustrated; The Mammary Apparatus of the Mammalia in the Light of Protogenesis and Phylogenesis, Prof. E. Bresslau, illustrated; British Ferns and How to Know Them, S. L. Bastin, illustrated; British Insects and How to Know Them, H. Bastin, illustrated; Vegeculture: How to Grow Vegetables, Salads, and Herbs in Town and Country, H. A. Day. *John Murray.*—The Study of Animal Life, Prof. J. Arthur Thomson, new edition, illustrated; Horses, R. Pocock, with a preface by Prof. J. Cossar Ewart. *L. Reeve and Co., Ltd.*—The Flora of Tropical Africa, vol. ix., part i., and vol. vi., section 2, continuing the Moraceæ, by J. Hutchinson. *T. Fisher Unwin, Ltd.*—Studies in Insect Life and other Essays, Dr. A. E. Shipley, illustrated.

CHEMISTRY.

Baillière, Tindall and Cox.—Chemistry for Beginners, C. T. Kingzett. *Cambridge University Press.*—Chemistry and Technology of Oils and Fats, F. E. Weston and P. J. Fryer; Chemistry of Dyeing, Dr. L. L. Lloyd and M. Fort. *J. and A. Churchill.*—Explosives: their History, Manufacture, Properties, and Tests, A. Marshall, new edition in 2 vols. *Constable and Co., Ltd.*—Ozone: its Properties, Manufacture, and Uses, Dr. A. Vosmaer, illustrated; Chemical Calculations, Dr. H. Ashley, illustrated; Elements of Industrial Chemistry, A. Rogers, illustrated; The Theory and Use of Indicators, Dr. E. B. R. Prideaux; Mining and Mine Ventilation, J. J. Walsh, illustrated; Photography, A. H. Watkins, new edition, illustrated. *Gurney and Jackson.*—Supplementary volume to Prof. Lunge's Sulphuric Acid and Alkali, vol. i., dealing with the latest developments in this branch of chemical technology. *Crosby Lockwood and Son.*—Industrial and Manufacturing Chemistry: Inorganic, Dr. G. Martin, 2 vols., illustrated. *Macmillan and Co., Ltd.*—A Text-book of Thermo-chemistry and Thermodynamics, Prof. O. Sackur, translated and revised by Dr. G. E. Gibson. *University Tutorial Press, Ltd.*—Tutorial Chemistry, Dr. G. H. Bailey, part ii., Metals and Physical Chemistry, new edition.

ENGINEERING.

Chapman and Hall, Ltd.—Treatise on Hydraulics, M. Merriman, new edition; Municipal Engineering Practice, A. P. Folwell; Elements of Refrigeration: a Text-book for Students, Engineers, and Warehousemen, Prof. A. M. Greene, Jr.; Water Supply, Prof. W. P. Mason, new edition; Laboratory Manual of Bituminous Materials for the Use of Students in Highway Engineering, P. Hubbard; Underpinning of Buildings, L. White and E. A. Prentiss; Concrete, Plain and Reinforced, the late Dr. F. W. Taylor and S. E. Thompson, new edition; The Design of Railway Location, C. C. Williams; The Engineers' Manual, R. G. Hudson, assisted by Dr. J. Lipka, H. B. Luther, and D. Peabody, Jr.; Elementary Cams, Prof. F. D. Furman. *Constable and Co., Ltd.*—Text-book of Motor-car Engineering, A. G. Clarke, vol. ii., Design, illustrated; Turbines Applied to Marine Propulsion, S. J. Reed, new edition, illustrated; Essentials of Electrical Engineering, J. F. Wilson, illustrated; Railway-maintenance Engineering: with Notes on Construction, W. H. Sellew, illustrated; Design of Marine Engines and Auxiliaries, E. M. Bragg, illustrated. *The "Electrician" Printing and Publishing Co., Ltd.*—The Theory of the Submarine Cable, Dr. H. W. Malcolm; Electric Measuring Instruments: their Design, Construction, and Application, Dr. C. V. Drysdale and A. C. Jolley; and new editions of Electric Mains and Distributing Systems, J. R. Dick and F. Fernie; Aitken's Manual of the Telephone; Submarine Cable Laying and Repairing, H. D. Wilkinson; Electricity Meters: their Construction and Management, C. H. W. Gerhardi; Primary Batteries: their Construction and Use, W. R. Cooper. *Crosby Lockwood and Son.*—The Aviation Pocket Book for 1917, illustrated, R. B. Matthews; The Engineer's Year-book for 1917, comprising formulæ, rules, tables, data, and memoranda, forming a compendium of the modern practice of civil, mechanical, electrical, marine, gas, and mine engineering, H. R. Kempe, illustrated; *Longmans and Co.*—Steam Turbines: a Text-book for Engineering Students, W. J. Goudie, illustrated; Tube Teeth and Porcelain Rods, Dr. J. Girdwood, illustrated; Warships: a Text-book on the Construction, Protection, Stability, Turning, etc., of War Vessels, E. L. Attwood, new edition. *Whittaker and Co.*—Manuals of Aeronautics, vol. ii., Properties of Aero-foils and Resistance of Aero-dynamic Bodies, A. W. Judge, illustrated; Modern Milling, E. Pull, illustrated; Continuous-current Motors and Control Apparatus, W. P. Maycock, illustrated; Electric Traction: A Treatise on the Application of Electric Power to Electric Traction on Railways and Tramways, A. Dover, illustrated; Power Wiring Diagrams: for users of electric-power plant, A. Dover.

GEOGRAPHY AND TRAVEL.

Macmillan and Co., Ltd.—Highways and Byways in Wiltshire, E. Hutton, with illustrations by Nelly Erichsen. *Methuen and Co., Ltd.*—Argentina and Uruguay, H. J. G. Ross, illustrated. *John Murray.*—Hunting Pygmies, Dr W. E. Geil, illustrated.

GEOLOGY AND MINERALOGY.

Chapman and Hall, Ltd.—Pocket Handbook of Minerals, G. M. Butler, new edition. *Gurney and Jackson.*—The Banket: A Study of the Auriferous Conglomerates of the Witwatersrand and the Associated Rocks, Prof. R. B. Young. *John Murray.*—Volcanic Studies in Many Lands, the late Dr. Tempest Anderson, 2nd series, illustrated.

MATHEMATICAL AND PHYSICAL SCIENCES.

Edward Arnold.—Notes on Navigation, Naval Instructor S. F. Card, new and revised edition. *Cambridge University Press.*—The Psychology of Sound, Dr. H. J. Watt; Optical Theories: based on Lectures delivered before the Calcutta University, Dr. D. N. Mallik; A Treatise on the Analytical Dynamics of Particles and Rigid Bodies: with an Introduction to the Problem of Three Bodies, Dr. E. T. Whittaker, new edition. *Chapman and Hall, Ltd.*—Differential Calculus, H. B. Phillips; Elliptic Integrals, Prof. H. Hancock (Mathematical Monograph Series); Field Astronomy, Prof. A. H. Holt. *Constable and Co., Ltd.*—Ranges of Electric Searchlight Projectors, J. Rey, translated by J. H. Johnson, illustrated; Practical Surveying, E. McCullough, illustrated. *Longmans and Co.*—Differential Equations, Dr. H. Bateman; Practical Arithmetic and Mensuration, F. M. Saxelby and C. H. Saxelby; X-rays: an Introduction to the Study of Röntgen Rays, Capt. G. W. C. Kaye, new edition. *Methuen and Co., Ltd.*—Housecraft Science, E. D. Griffiths, illustrated. *T. Murby and Co.*—Electrical Experiments, A. R. Palmer. *University Tutorial Press, Ltd.*—Advanced Text-book of Magnetism and Electricity, R. W. Hutchinson, two vols.; Intermediate Magnetism and Electricity, R. W. Hutchinson; Elements of Physical Science, edited by Dr. W. Briggs, new edition.

MEDICAL SCIENCE.

Baillière, Tindall and Cox.—Field Sanitation, Capt. C. G. Moor, illustrated; The Organs of Internal Secretion: their Diseases and Therapeutic Application, Dr. I. G. Cobb; Physical Remedies: being Practical Treatment by Mechanical Apparatus, such as Exercise and Medical Gymnastics, Heat and Cold in Baths, Electricity, Radiation, and Massage, Dr. R. F. Fox, illustrated; The Pituitary Gland, Dr. R. B. Bell. *Cambridge University Press.*—The Spread of Tuberculosis, Dr. L. Cobbett (Cambridge Public Health Series). *Cassell and Co., Ltd.*—The Nation's Health, Sir Malcolm Morris; Electrical Treatment, Dr. W. Harris, new edition, illustrated. *J. and A. Churchill.*—New editions of Sanitation in War, Major P. S. Lelean, illustrated; and Minor Surgery and Bandaging, H. M. Davies. *Constable and Co., Ltd.*—Health and the State, Dr. W. A. Brend. *W. Heinemann.*—Malingering; or, The Simulation of Disease, A. B. Jones and Ll. J. Llewellyn, with a chapter on Malingering in Relation to the Eye, W. M. Beaumont; Painless Childbirth: A general survey of all painless methods, with special stress on "Twilight Sleep" and its extension to America, M. Tracy and M. Boyd; Studies in Forensic Psychiatry, Dr. B. Glueck (Criminal Science Monographs); Cerebellar Abscess: its Etiology, Pathology, Diagnosis, and Treatment, including Anatomy and Physiology of the Cerebellum, Dr. I. Friesner and Dr. A. Braun. *Longmans and Co.*—The Physiology of Food and Economy in Diet, Prof. W. M. Bayliss; The Secretion of Urine, Prof. A. R. Cushny. *Macmillan and Co., Ltd.*—Human Physiology, Prof. L. Luciani, translated by Frances A. Welby, with a preface by Prof. J. N. Langley, illustrated, in 5 vols., vol. iv., edited by Dr. G. M. Holmes. *Masson et Cie* (Paris).—Collection de Précis de Médecine et de Chirurgie de guerre:—Traitement des Fractures, R. Leriche, tome ii.; Hystérie-Pithiatisme et Troubles nerveux d'ordre réflexe en Neurologie de guerre, J. Babinski and J. Froment; Psychonévroses de guerre, Drs. G. Roussy and J. Lhermitte; Blessures de la Moelle et de la Queue de cheval, Formes cliniques et anatomiques, Traitement, Drs. G. Roussy and J. Lhermitte; Traitement et Restauration des Lésions des Nerfs, Mme. Athanassio-Benisty; Blessures du Crâne et du Cerveau, Formes cliniques et Traitement médico-chirurgical, C. Chatelin and de Martel; Les Fractures de la Mâchoire inférieure en Chirurgie de guerre, L. Imbert and P. Réal; Les Fractures de l'Orbite par Blessures de guerre, Prof. F. Lagrange; La Prothèse des Membres en Chirurgie de guerre, Prof. A. Broca and Ducroquet; Localisation et extraction des projectiles, Prof. Ombrédanne and R. Ledoux-Lebard; Guide pratique du Médecin dans les Expertises médico-légales militaires, Ducos and Blum. *Methuen and Co., Ltd.*—Tuberculosis, Dr. C. Riviere (Methuen's Health Series).

TECHNOLOGY.

Cambridge University Press.—Experimental Building Science, J. L. Manson, vol. i., Naval Architecture, J. E. Steele. *Constable and Co., Ltd.*—Wool, F. Ormerod, illustrated. *Crosby Lockwood and Son.*—In the "Books for Home Study" Series: Automobile Driving and Repairs, Hall and Cravens; Foundry Work, Gray; Refrigeration, Arrowood; Plumbing, Gray and Ball; Patternmaking, Ritchey and Monroe. *John Murray.*—Cotton and other Vegetable Fibres, Dr. E. Goulding (Imperial Institute Handbooks). *Scott, Greenwood and Son.*—Elementary Mathematics for Engineers and Architects, E. H. Sprague; Calculations for Steel Frame Structures, W. C. Cocking; Driving of Machine Tools, T. R. Shaw; Design of Machine Elements, W. G. Dunkley, 2 vols.; Elements of Graphic Statics, E. H. Sprague; Strength of Structural Elements, E. H. Sprague; Portland Cement: its Properties and Manufacture, P. C. H. West; Gear Cutting, G. W. Burley; Moving Loads by Influence Lines and other Methods, E. H. Sprague; Drawing Office Practice, W. Clegg; Estimating Steelwork for Buildings, B. P. F. Gleed and S. Bylander; The Theory of the Centrifugal and Turbo Pump, J. W. Cameron; Strength of Ships, J. B. Thomas; Machine-shop Practice, G. W. Burley; Iron and Steel, J. S. G. Primrose; Electric Traction, H. M. Sayers; Precision Grinding Machines, T. R. Shaw. *Whittaker and Co.*—International Technical Dictionary in English, French, Italian, and German, E. Webber.

MISCELLANEOUS.

A. and C. Black, Ltd.—An Introduction to the Physiology and Psychology of Sex: an Outline for Beginners, Dr. S. Herbert. *Cambridge University Press.*—Comptes Rendus of Observation and Reasoning, J. Y. Buchanan; Science and the Nation: Essays by Cambridge Graduates, with an introduction by Lord Moulton, edited by Prof. A. C. Seward; The Combination of Observations, D. Brunt. *Cassell and Co., Ltd.*—Psychical Investigations, J. Arthur Hill; The Borderlands of Science, Dr. A. T. Schofield. *Chapman and Hall, Ltd.*—Handbook for Rangers and Woodsmen, J. L. B. Taylor. *Wells Gardner, Darton and Co., Ltd.*—Story Lives of Great Scientists. *Macmillan and Co., Ltd.*—The Economic Annals of the Nineteenth Century, the late Prof. W. Smart, vol. ii., 1821–1830. *John Murray.*—The War and the Nation: a Study in Constructive Politics, W. C. D. Whetham. *Smith, Elder and Co.*—The Life and Letters of Sir J. D. Hooker, O.M., G.C.S.I., L. Huxley, 2 vols. *Watts and Co.*—The Origin of the World, new and cheaper edition.

RESEARCH IN INDUSTRIAL LABORATORIES.[1]

The Organisation of Industrial Research.

IT is generally conceded by those engaged in the direction of industrial research that, in order to be efficient, research laboratories of this type should be as thoroughly equipped as possible. In the case of industrial concerns having a number of plants and in the case of organisations of manufacturers, the tendency of organisation should undoubtedly be towards concentration and co-operation in the maintenance of one large well-equipped research laboratory, rather than towards the erection and support of a number of smaller separated laboratories. It is, of course, necessary, especially in the case of chemical plants, that the analytical and control work should be carried out *in situ*, but experience indicates that it is much better practice to centralise the research work.

Since the policy which ensures adequate guidance to a research organisation must be based upon the accumulation of facts, method in laboratory administration should provide for facilities for securing detailed information on a vast field, and for competent counsel from those who have a store of specialised knowledge. When the laboratory executive's work has passed the one-man stage, a division of labour comes about, and it is here that he must see to it that he surrounds himself with men who are capable of effective effort—alert, original investigators of initiative and leadership.

An organised research administrative staff should result not only in effective division of labour, but also

[1] Report of a Sub-committee on Research in Industrial Laboratories, consisting of Drs. R. F. Bacon (chairman), C. E. K. Mees, W. H. Walker, M. C. Whitaker, W. R Whitney, and presented at the meeting of the Committee of One Hundred on Scientific Research, New York, of the American Association for the Advancement of Science, December 26, 1916.

in efficient expenditure of executive energy, more effective plans, and general stabilisation. This can come about if there is a pervading organisation type of mind, which "is common to those drilled in systematic thinking and long immersed in the materials of their particular vocation. Such a mind sees details, but only as parts of a whole; reaches generalisations, but by the inductive route."

With regard to the investigatory staff, while the individual can exert only a very small influence except as a member of an organisation or institution, yet a research institution never gains note or influence except through the attainments and achievements of its individual members. The research department of a large industrial concern will be great because it has investigators on its staff who possess great originality and ability and because its director is wise and far-sighted. It is generally conceded that the personal factor is always paramount in industrial research, and that, as in every other organisation, the control of men is the real problem in laboratory administration.

A brief consideration of the conditions favourable to both pure and industrial research is pertinent in connection with any discussion of the personal organisation.

It is particularly adverse to progress to regard able investigators as abnormal men; for successful research demands neither any peculiar conformity nor any peculiar deformity of mind, but it requires, rather, peculiar normality and unusual industry and patience. It is little less inimical to expect productive work from those who are absorbingly preoccupied with other affairs than research; for fruitful scientific inquiry entails, in general, prolonged and arduous, if not exhausting, labour, for which all the researcher's time is none too much. This is the experience of the Carnegie Institution and all other research organisations. It is only to be expected, therefore, that those most likely to produce important results in research are those who have qualified for the responsibilities thereof by the completion and publication of several worthy investigations, and who are at the same time able to devote the bulk of their energies thereto. The productive researchers in our universities are those who are devoting their whole time, or practically their whole time, to investigatory work.[2]

Research should never be allowed to fall into the rut of prosaic routine. The *personnel* of the investigatory staff should be maintained at the very highest standard, and all administrative plans should be carried out with enthusiasm and earnestness.

In the research laboratories of manufacturing plants the personal co-operation of the research staff with the members of other branches of the organisation always proves an important aid in maintaining interest in the work and is, in addition, mutually educating.[3] In particular, the research department should have an *esprit de corps* that keeps things moving and should lead the way so strikingly as to be apparent to all other departments of the corporation. In consequence, mediocrity should never be tolerated. It should be borne in mind, however, that the research man can only accomplish efficient work when he is free from restraint and petty annoyances.

[2] As a rule, the head professors of chemistry in the larger universities are not giving more than three to five hours of lectures during the week, the rest of their time being devoted to research, while a number of them have one or more private research assistants, besides the candidates for advanced degrees, doing research work.

[3] In several of our largest corporations the plant superintendents make monthly reports to the research departments, including all ideas of their own or of their assistants which may in any way warrant investigation. Then, too, the salesmen report regularly to the research department regarding the various ways in which the company's products are used and what substitutes are employed for the company's products. Such plans stimulate closer thought and observation.

Co-operation is always contributory to success in a research laboratory, and, other conditions being equal, the valuable men are the ones who can and will co-operate with one another. As in business, men succeed only as they utilise the ideas and services of other men. It follows, therefore, that the strength of an investigatory staff, properly operated, should increase more rapidly than the increase of its numbers, and that a fraternal spirit will play an important *rôle* in the productiveness of any research department.

The experience in several of our most successful industrial research laboratories has clearly shown that co-operation between the different departments thereof can be adequately and completely obtained by well-planned weekly conferences on the subjects under study. While some directors of industrial research hesitate to spend the time which these conferences entail, it is the opinion of the sub-committee that conferences of this nature are worth far more than the time they take.

The Selection and Training of Students for Industrial Research.

Research leading to the discovery of new ideas requires not only intellect and training, but also initiative or genius; it can come only from an individual who possesses unusual intuition and insight. It follows, therefore, that there is a scarcity of men gifted with the genius for industrial research, and that it requires much experience in selecting suitable men and in training them to the desirable degree of efficiency, after having determined the particular qualities required.

The important requisites for industrial research are often unconsidered by manufacturers, who, in endeavouring to select a research chemist, are likely to regard every chemist as a qualified scientific scout. The supply of men capable of working at high efficiency as investigators is well below the demand; and chemists having the requisites and spirit of the researcher are indeed difficult to find even by those experienced in the direction of research. All research professors know that the location of a skilled private assistant—one who possesses not only originality, but also sound judgment and intellectual honesty—is not easy, because it frequently involves the gift of prophecy on the part of the searcher.[4] It has been truly said that the "seeds of great discoveries are constantly floating around us, but they only take root in minds well prepared to receive them."

On account of the extraordinary importance of new ideas, particular emphasis should always be laid upon finding and supporting brilliant researchers. Such individuals can best be found in the universities. The function of the university is to work with the beneficent idea of increasing the sum of human knowledge, and among its most valuable products are those who will work for the exercise of the investigative instinct and the pleasure of overcoming difficulties.

The examination of the training necessary for those proposing to take up industrial research which is common with all scientifically trained men, is too extensive a subject to be discussed by the sub-committee at this time. It is, however, appropriate to consider those subjects in which it seems desirable for the prospective researcher to specialise: reference is, of course, made to subjects other than those required by the average student of the sciences as distinguished from their industrial application, but the assumption is not made that what is desirable for research work should not also be available for all.

Research men frequently possess adequate training

[4] See discussion in *Science*, N.S., 41 (1915), p. 319.

and scientific acumen, but fail in their ability to use such. There is no question that the element most noticeably lacking in the modern graduate is *resourcefulness*. A qualified research chemist who possesses initiative is usually a creator; but owing to the neglect of existing difficulties in chemical pedagogy, the present-day graduates of our schools of chemistry are too often deficient in inspiration, ingenuity, and insight.

The failure to provide adequate and systematic instruction in chemical literature is illustrative of this contention.

Before commencing laboratory work upon any problem, it is obviously necessary to digest intelligently the important contributions which have been made upon the subject and to take advantage of what other workers have done in the same field. The average graduate is usually almost helpless when attempting to do this, and consequently requires close supervision. The main difficulties are:—

(*a*) He does not know how to go about it; he does not know where to look as the most probable source; and he is not familiar with the standard treatises and important journals.

(*b*) He fails to analyse the subject into its factors and hence generally looks for topics which are too general. Because he does not find any reference to the problem as a whole as he has it in mind, he assumes that nothing has been done upon it and that there is nothing in the literature which will be of aid to him in the investigation. Were he to separate his subject into its essential parts and then to consult the literature on each factor, he would find considerable information which he otherwise would miss.

(*c*) He does not critically digest the articles under examination, but often he makes only a few disconnected quotations and fails to interpret the work done.

The solution is to be found in the provision in the chemical curriculum, preferably in the senior year, of a course of lectures on the literature of chemistry, with particular reference to the character of the writings and the status of the authors. The purpose of these lectures should be to present a general survey of the voluminous literature and to impart an accurate, systematic working knowledge of chemical bibliography. A concurrent seminar should be devoted to indexing and tracing chemical literature, to the cultivation of an acquaintanceship with authorities, and to the solution of bibliographic problems.

The sub-committee also recommends that pedagogic attention be given to the arrangement of a course of study in the principles of technical reporting and in the criteria of literary excellence in the preparation of reports of researches and professional reports. The completion of such a subject, with its accompanying analysis, practice, and criticism, would usefully supplement the training received in chemical bibliography and would develop a capability which is much needed by chemical graduates.

It may be noted in passing that, during the academic year 1914–15, distinct courses in chemical literature and in technical reporting were established at the University of Pittsburgh. Much success has attended this pedagogic innovation.

The chemical graduate of to-day is also deplorably deficient in resourcefulness in planning research. While this is an extensive subject, a research student may be trained in correct methods of attack, namely:—

(*a*) *Analytical Methods.*—Almost all investigations require analytical control. In no feature of chemical work is there more apparent an inability to use the analytical training which the man has received.

(*b*) *Planning the Investigation.*—Resourcefulness in separating a problem into its essential factors and in clearly grasping the inter-relationship of these factors is most important. Too many men desire to start in at once and solve the problem at the first attempt. All this might be summed up in the expression "methods of research."

(*c*) *Apparatus.*—The sub-committee has not considered just how a man could be trained to be more resourceful in this respect, but it is surely a marked weakness in the average graduate. While a native cleverness is doubtless born, and not made, it ought to be possible to give the undergraduate some training in the use of his mental equipment in designing and planning apparatus which is to accomplish the desired end.

The Factors involved in the Promotion of Co-operation between Manufacturers and the Universities.[5]

The recent impetus imparted to the research activities in American chemical manufacturing has materially altered the traditional policy of industrial secrecy. A striking illustration of this improvement is to be found in the reports of the Industrial Conferences held at the fifty-third meeting of the American Chemical Society.[6] This change in attitude, a natural result of the appreciation of urgent action in industrial research, has long been desired by our universities, and it will undoubtedly result in the extension of the practice of referring certain of the problems of industry to university laboratories for study. Many of the numerous problems of chemical as well as mechanical technology could be advantageously attacked outside of the plants, but some central organisation is needed for securing and properly distributing those problems which are pressing. It is clear, however, that stable relations between the universities and industrialists will be worth while only if some mutual benefit can accrue therefrom. This co-operation can therefore be most satisfactorily promoted by actively demonstrating the advantages of the exchange or interchange of subjects for research, which primarily presupposes a reasonable freedom from the concealment of knowledge which persistently adheres to all industrial research.

Industrial research laboratories can be of mutual aid by supplying advice and materials. These laboratories should also publish reports of investigations just as freely as possible and thus, by proving the utility of it, assist in the general scheme of the universities—promote the dissemination of knowledge.

In general, the sub-committee endorses the conclusions of the University and Industry Committee of the New York Section of the American Chemical Society.[7]

The Promotion of a Better Appreciation of Research.

The promotion of a better appreciation of research by the general public can only be obtained by publicity.[8] No complaint can be made of a lack of this at the present time. The large corporations supporting industrial laboratories are themselves expending great sums on giving publicity to their research work. The sub-committee thinks, however, that though the general public now appreciates the value of scientific research, the thing required to increase the number

[5] The president of the American Chemical Society has been authorised to appoint a central committee from representatives of the universities and the industries to study opportunities and to make recommendations for co-operation.

[6] See *J. Ind. Eng. Chem.*, 8 (1916), pp. 947 *et seq.*

[7] See *J. Ind. Eng. Chem.*, 8 (1916), p. 658.

[8] It is important to mention here that the American Chemical Society has under consideration the publication of a journal of popular chemistry, a periodical for which there is a real need because of the desirability of the proper dissemination of chemical information to the public.

of laboratories is more information as to specific plans for starting and running them. General articles on the advantages of research work would be very much helped in carrying conviction if they were accompanied by definite proposals telling manufacturers of different industries and of different grades in the size of their work what they could do in the way of research work themselves.

The average person who has to decide whether his corporation will support research work can, in the nature of things, know little about it. He desires either to spend much less than is necessary for effective work, or he is frightened by the size of the expenditure which he thinks will be necessary. More specific information would enable him to form a truer idea as to what he was committing himself and what he was likely to get.

So far as possible, arrangements should be made for research institutions to have information as to their work available and to persuade them to give this information freely to inquirers. It would be a considerable step in co-operative effort if all the research institutions that can be reached could be persuaded to put information regarding themselves into some form so that a comparison could be made.

The Establishment of Stable Relations between Research Institutions and the Research Departments of Industrial Plants.

The suggestion has been frequently made that the establishment of stable relations between the types of organisations mentioned might be effected if a small group of selected representatives thereof could arrange to confer at regular times. After consideration, the sub-committee recommends the formation of an association of research institutions—that is, an association of all those bodies engaged in scientific and scientific industrial research, including such organisations as the research laboratories of Harvard University, the Massachusetts Institute of Technology, and other educational institutions, the Carnegie Institution laboratories, the Mellon Institute of Industrial Research, and the research laboratories of the corporations which are conducting a certain amount of research of scientific importance. Undoubtedly, an association of this nature would meet with satisfactory support, and it would eventually prove an important factor in improving the methods of research organisation.

Stable relations between various research organisations will be worth while only if some mutual benefits can accrue. These can be brought about by an exchange or interchange of "commodities," such as—

(*a*) Subjects for research.

(*b*) Special facilities for extraordinary conditions, such as extreme pressures, extremes of temperatures, etc.

(*c*) Special pieces of expensive apparatus.

(*d*) Helpful ideas on research already in progress.

(*e*) Candidates for employment.

This presupposes a freedom from the secrecy which still surrounds the industrial research of certain organisations. Undue secrecy is unnecessary and unwise, but it is only in those cases where publicity is compatible with industrial progress that full co-operation between the universities and the industries can be effected.

A Comparative Study of Investigational Activities.

This study would be distinctly worth while, but before the initiation of such a movement there must first be established more mutual confidence than now exists. A comparative study of this kind would be very difficult and would necessitate the expenditure of much time. Probably such information could be secured by obtaining the reports regarding the industrial research laboratories in operation, and there is no reason why a suitable questionnaire could not be prepared and distributed, in order to obtain information regarding research conditions and comparative data relating to the organisations maintaining laboratories.

It would be very useful indeed to have available a year-book pertaining to research laboratories, with the following lines of information: institutions, organisations or concerns supporting them, approximate purpose of laboratory, divisions of science represented therein, manufacturing facilities directly associated therewith, approximate annual expenditure for maintenance of research, number, and particulars relating to the training, of the members of the investigatory staff, and, finally, a list of the scientific publications for the past year. Such a book might also advantageously include mention of the special equipment of the laboratories unlikely to be possessed by every similar institution.

The National Research Council, through its committee on research in educational institutions, could well arrange to have some one whose sole duty it was to co-ordinate the work in university laboratories with reference to general or national welfare. While any attempt which may be made by a national society or association to secure co-operation between industrial and institutional laboratories will invariably encounter the difficulty of vested interests, an organisation with Governmental support might accomplish much fruitful research work through institutions of learning and in such a way that this would be of material benefit to the institutions concerned, as well as to the nation.

R. F. BACON,
Chairman,
C. E. K. MEES,
W. H. WALKER,
M. C. WHITAKER,
W. R. WHITNEY.

Pittsburgh, Pa.,
December 15, 1916.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—On February 6 Convocation passed, *nem. con.*, a series of decrees providing for the administration of the important bequest received under the will of the late Christopher Welch, M.A., of Wadham College. The income derived from the trust is to be applied to the establishment of four scholarships, each of the value of £100 a year, for the promotion of the study of biology, and more especially for the encouragement of such students as give proof of capacity for original observation and research. Each scholarship is to be tenable for four years, and candidates may offer any one of the subjects botany, animal physiology, and zoology. The bequest is a valuable addition to the means at the disposal of the university for the promotion of scientific research.

The report of the Committee for Anthropology, lately issued, gives an account of the instruction offered during the past year in physical and social anthropology, geographical distribution, prehistoric archæology, and technology. Despite unfavourable conditions, eight fresh students entered their names on the register during the year.

MR. E. J. C. RENNIE, son of Prof. Rennie, of the University of Adelaide, has been appointed acting lecturer in electrical engineering in the University of Melbourne. He will take the place of Mr. E. B. Brown, who is about to engage in munition work in this country.

THREE letters on "Science in the School," contributed during last autumn to the *Educational Supplement of the Times* by Sir Clifford Allbutt, K.C.B., have been published in pamphlet form by Messrs. W. Heffer and Sons, Ltd., of Cambridge, at the price of 6*d*. net. Attention has been directed already in these columns (vol. xcviii., p. 241) to the argument of the letters, and it will be sufficient here to point out that the first letter may be summarised by quoting its concluding sentence:—"The 'science' we need in schools is a scientific method of teaching all things." The subsequent letters elaborate this definition. "It matters less," says the second letter, "what a boy is taught than how it is taught." "We need science in our 'classics' as we need humanity in our science." Similarly, in the third letter, we find:—"The cry of *what* is to be taught to boys is of less importance than the vision of *how* things are to be taught." "To regenerate all teaching by the spirit and method of science is far more important than the inculcation of special sciences." It may be hoped that the pamphlet will secure a wide distribution, for its lessons deserve frequent repetition in view of the reconstruction which the coming of peace will bring.

AT the opening of the New York State Museum in the State Education Building, Albany, New York, on December 29 last, Mr. Theodore Roosevelt gave an address on productive scientific scholarship, which is published in the issue of *Science* for January 5. Describing the functions of a museum, Mr. Roosevelt laid special emphasis on the need for it to give research facilities to the extraordinary and exceptional student, "the man who has in him a touch of the purple; the man who can supply that leadership without which it is so rare for even the laborious and well-directed work of multitudes of ordinary men to realise the ideal of large productive achievement." Later, in contrasting utilitarian with pure science, he said there is a twofold warrant for the encouragement of the study of pure science by the State. First, the knowledge justifies itself. Secondly, the greatest utilitarian discoveries have often resulted from scientific investigations which had no distinct utilitarian purpose. It is impossible to tell at what point independent investigation into the workings of Nature may prove to have an immediate and direct connection with the betterment of man's physical condition. The greatest need to-day, and the need most difficult to meet, is to develop great leaders, and to give full play to their activities. But it must also be our aim to develop men who, if they do not stand on the heights of greatness, shall at least occupy responsible positions of leadership.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Meteorological Society, January 17.—Major H. G. Lyons, president, in the chair.—Major H. G. **Lyons** (presidential address): The winds of North Africa. It is now thirty years since the distribution of pressure over the region lying to the south of Europe was discussed, and during this period many new stations have been established. From the Mediterranean to the equator material is now available from about eighty stations, and a more trustworthy estimate of the distribution of pressure over North Africa and the consequent flow of the air currents can now be formed.

Geological Society, January 24.—Dr. Alfred Harker, president, in the chair.—Dr. Aubrey Strahan said that in 1914 a proposal was made to subscribe for a bust of Sir Archibald Geikie which would be presented to the Board of Education for preservation in the Museum of Practical Geology. A marble bust, executed by Prof. E. Lantéri, was presented to the board on March 14, 1916, and placed in the museum. The staff of the Geological Survey and Museum, thinking that a copy of the original model of the bust would be a suitable gift to the Geological Society of London, had caused a cast to be made, and Dr. Strahan, on their behalf, offered it for the acceptance of the society. The president gratefully accepted the gift on behalf of the fellows.—**Scoresby Routledge**: An account of Easter Island. An expedition was organised so that Easter Island, and other islands most near to it, should be thoroughly examined, and all information and material should be considered on the spot, or, if possible, be brought back for comparative study. The geologist of the expedition, the late Mr. F. L. Corry, contracted typhoid fever on the Chilean coast and never recovered sufficiently to rejoin the expedition. Hence no formal geological report on the island could be submitted. The conditions on Easter Island were illustrated by a series of photographs taken to illustrate geological features. The island was described as a plateau of basalt raised from 50 to 100 ft. above the sea. Superimposed on this were numerous cones ranging up to nearly 2000 feet. The plateau was covered but sparsely with soil, and could only be crossed with difficulty in any direct line. The cones, on the other hand, were generally smooth of surface, with a good depth of soil.

MANCHESTER.

Literary and Philosophic Society, January 9.—Prof. S. J. Hickson, president, in the chair.—F. **Jones**: Note on the action of hydrogen on sulphuric acid. Many years ago the author noticed that pure hydrogen, when left in contact with strong sulphuric acid, had a strong odour of sulphur dioxide. It appeared that hydrogen had reduced the acid in accordance with the equation $H_2SO_4+H_2=SO_2+2H_2O$. The action of *nascent* hydrogen on the acid was examined by Faraday in 1834. He found that when the strong acid was submitted to electrolysis, oxygen appeared at the anode, and hydrogen and sulphur at the cathode. Subsequent observers stated that no action took place between hydrogen and sulphuric acid at ordinary temperatures, but Berthelot maintained the opposite view. The author devised an experiment to show that action does take place at ordinary temperatures. Sulphuric acid is placed in the bulb of a non-tubulated retort containing hydrogen. The point is dipped under water, which slowly rises in the neck of the retort as the formation of sulphur dioxide proceeds.—T. A. **Coward**: An undescribed habit of the field vole. Mr. Coward said that towards the close of 1916 he found three field voles in nests, three to six feet above ground, in an osier-bed at Rostherne, Cheshire. One nest had probably been entirely constructed by the vole; the others were built upon old nests of birds. The voles were dead—one so recently that the fleas had not left it. The field vole, though capable of climbing, is terrestrial in habits, nesting on or beneath the ground; it is not known to hibernate, and is constantly abroad in hard weather. Collett records a bank vole making a similar elevated nest in Norway, but as an exceptional case. The osier-bed is frequently flooded, and during the frosts and thaws in December underground nests would have been death-traps, and the cause of death may perhaps be explained by the rapid changes in the weather, driving the voles to the elevated but exposed positions, where from habit they gathered only the quantity of material which would have sufficed to protect them in a burrow.

EDINBURGH.

Royal Society, December 4, 1916.—Dr. J. Horne, president, in the chair.—Miss Margaret **Ferguson**: The family budgets and dietaries of forty labouring-class families in Glasgow in war-time. The paper was founded upon statistics which had been gathered in connection with the investigation into the causes of rickets now being carried out by the Medical Research Committee of the National Insurance Act. The average income in war-time was about 42 per cent. higher than in the years preceding the war, and the average expenditure for food and rent was 37 per cent. higher. The supply of food energy was much the same. The consumption of proteins had fallen, that of fats risen, the latter fact being explained as due to the increased consumption of margarine. While the cost of food had risen about 50 per cent., the cost of living had increased only 36 per cent., thus leaving a greater surplus for other expenditures.—P. **MacNair**: The Hurlet sequence in the east of Scotland. The purpose of the paper was to correlate various members of the lower Limestone series of the Carboniferous rocks in the east and west of Scotland, and, in particular, to compare certain sections in the east with the well-known sequence at Hurlet between Glasgow and Paisley. The various Limestone horizons which were so correlated were characterised by a faunal association by means of which they could be traced over wide areas. This faunal association had been discovered by the author everywhere in the same position throughout the west of Scotland, and a similar fauna existed at Abden, in Fife, and in other localities in the Lothians. Its importance lay in the fact that it formed a well-marked datum line from which to determine the positions of the other members of the series.

December 18, 1916.—Dr. J. Horne, president, in the chair.—G. P. **Darnell-Smith**: The gametophyte of Psilotum. This formed one of a series of investigations now being carried out in the University of Sydney.—J. **Russell**: Transverse and codirectional induction changes in demagnetised iron and nickel in relation to the molecular theory of magnetism. When a rod of iron or nickel has been demagnetised by reversals, the application of a magnetising force at right angles to the original direction of magnetisation produces induction changes in that direction. The experimental results were compared with theoretical deductions based upon certain assumptions concerning the distribution as regards orientation of the molecules constituting the magnetic matter. Good agreements were obtained.—Prof. W. **Peddie**: The magnetic test of molecular arrangement in crystals: Magnetite and the α, β, and γ forms of iron. Iron exists in these three crystalline forms, of which α is the magnetic one. The author previously showed that the magnetic quality of α crystals, as tested by Weiss, proved that the arrangement of the magnetic molecules could not be on a simple cubic lattice, but might be on a face-centred lattice. The only other possible lattice is that of the centred cube. In the present paper it is shown that this lattice also could not give the observed characteristics. Therefore, the arrangement is on the face-centred lattice. The X-ray test has already led to this conclusion. It is shown also that the centred cubic lattice arrangement readily gives a non-magnetic grouping of molecules, and, therefore, presumably exists in the β form. This leaves the open cubic arrangement as a possibility in the γ form. The value of the magnetic test is further illustrated by the possibility of a magnetic molecular arrangement in magnetite different from that given by Bragg, but also fairly well satisfying the X-ray test.

DUBLIN.

Royal Irish Academy, January 8.—The Most Rev. Dr. J. H. Bernard, president, in the chair.—D. **McArdle**: Musci and Hepaticæ of the Glen of the Downs, Co. Wicklow. The paper dealt with the moss and liverwort flora of the Glen of the Downs, a wooded Glacial "dry gap" near Bray, Co. Wicklow. Of mosses eighty species, and of hepatics thirty-seven species, were enumerated, of which about one-half were previously unrecorded from the county.

January 22.—The Most Rev. Dr. J. H. Bernard, president, in the chair.—F. L. **Hitchcock**: The simultaneous formulation of two linear vector functions. The author considers Joly's expressions for two linear vector quantities in terms of six vectors. The possibility of such reduction fails in certain cases, and methods are explained for proceeding in each case. Geometrical applications to the curve of intersection of two quadrics are given. The theorem, fundamental in the theory of quadratic vector functions, that the locus of the *irreducible* vector $V\phi\rho\theta\rho$ cannot be a fixed plane is proved.

NEW SOUTH WALES.

Linnean Society, November 22, 1916.—Mr. C. Hedley, vice-president, in the chair.—D. B. **Fry**: A new Batrachian genus from New Guinea, with comparative notes on the pectoral musculature. The new genus belongs to a group comprising sixteen out of the twenty-six genera of Brevicipitidæ (Engystomatidæ auct.) recorded from the Oriental and Australian regions, characterised by having a highly specialised, sternal apparatus, modified by the loss of the procoracoid cartilage and clavicles. Apart from sternal characters, its affinities appear to be about equally divided between Hylophorbus, Macleay (Mantophryne, Blgr., et auct.), and Metopostira, Méhely.—Dr. J. M. **Petrie**: The chemical investigation of some poisonous plants in the N.O. Solanaceæ. Part iii., The occurrence of nor-hyoscyamine in *Solandra longiflora*. The leaves are found to contain nor-hyoscyamine as the chief alkaloid. This was previously isolated and described by the author as a new alkaloid in 1907, under the name of "solandrine," and is now identified with the alkaloid which Carr and Reynolds isolated in 1912 from other solanaceous plants. Solandra also contains hyoscyamine in smaller amount, but scopolamines are absent. The total amount of alkaloid obtained was 0·17 per cent. in the leaves (dried at 100° C.).—G. I. **Playfair**: Australian fresh-water phytoplankton (Protococcoideæ). One new genus is proposed, and descriptions are given of sixty-one forms which appear to be new, eighteen being classed as species, thirty-seven as variations, and six as forms.—Dr. H. S. H. **Wardlaw**: The change of composition of alveolar air after the stoppage of normal breathing. When normal ventilation of the lungs is stopped, (*a*) by holding the breath, (*b*) by rebreathing the same quantity of air, the changes in the alveolar tensions of CO_2 and O_2 are exponential functions of the time for which ventilation is stopped. When the same air is rebreathed, the rates of change of the tensions are greater, and the final values approached are further removed from the original tensions than when the breath is simply held. In the latter case, (*a*). the values reached are close to those which have been given for the tensions in venous blood. In the former case, (*b*), the tension of CO_2 approached is considerably higher, while that of O_2 is considerably lower, being zero. Holding the breath under positive pressure seems to have no effect on the rate of change of composition of alveolar air, while negative pressure accelerates the change to the same extent as rebreath-

ing.—Dr. J. B. **Cleland** and E. **Cheel**: Records of Australian fungi, No. 1.—R. J. **Tillyard**: Further researches upon the problems of the radial and zygopterid sectors in the wings of Odonata, and upon the formation of bridges. In studying the tracheation of the rare larva of Neosticta (Protoneurinæ), the structure of the zygopterid sector (Ms) was found to be normal. But occasionally a peculiar abnormality occurs in one wing, trachea M_3 becoming hitched on to Ms near its base, while the supervening imaginal venation remains normal, so that the base of M_3 appears on the larval wing as a true bridge. This suggests that bridges in general are not cænogenetic developments in the venation, as held by Needham, but that they are the archaic condition, from which the tracheation has departed by specialisation. The question of the homology between Rs in Anisoptera and Ms in Zygoptera is dealt with by a complete marshalling of all the known evidence, both structural and ontogenetic. This is shown to be absolutely against the supposed homology. As a more probable explanation, the author suggests that the presence of two oblique veins in the archaic Petalurinæ and Cordulegastrinæ indicates the presence of both Ms and Rs in these forms, but that the Zygoptera, as a whole, have lost Rs by suppression at the subnodus, while all the rest of the Anisoptera only retain Ms as the bridge-vein basally, the more distal portion having become fused with Rs.

BOOKS RECEIVED.

How We Learn. By W. H. S. Jones. Pp. vii+64. (Cambridge: At the University Press.) 1*s*. 6*d*.

Nature Study Lessons seasonably Arranged. By J. B. Philip. Pp. ix+147. (Cambridge: At the University Press.) 2*s*. 6*d*. net.

Elementary Physics for Engineers. By J. Paley Yorke. Pp. viii+165. (Cambridge: At the University Press.) 4*s*. net.

Annuaire pour l'an 1917 publié par le Bureau des Longitudes. Avec des Notices Scientifiques. (Paris: Gauthier-Villars et Cie.) 2 francs net.

The Mythology of All Races. Oceanic. By Prof. R. B. Dixon. Pp. xv+364+plates xxiii and map. (Boston, Mass.: Marshall Jones Co.)

The Problem of Pain in Nature. By C. F. Newall. Pp. 131+7 illustrations. (Paisley: A. Gardner.) 3*s*. 6*d*. net.

Science in the School. By Sir Clifford Allbutt. Pp. 20. (Cambridge: W. Heffer and Sons, Ltd.) 6*d*. net.

DIARY OF SOCIETIES.

THURSDAY, FEBRUARY 8.

ROYAL SOCIETY, at 4.30.—The Dynamics of Revolving Fluids: Lord Rayleigh.—Deflection of the Vertical by Tidal Loading of the Earth's Surface: Prof. H. Lamb.—Spontaneous Generation of Heat in Recently Hardened Steel: C. F. Brush and Sir R. Hadfield.

ROYAL INSTITUTION, at 3.—The Mechanism of Chemical Change: Prof. F. G. Donnan.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Frequency Changers: R. Townend.

OPTICAL SOCIETY, at 7.30.—Annual Meeting.—More Notes on Glass Grinding and Polishing: J. W. French.

FRIDAY, FEBRUARY 9.

ROYAL INSTITUTION, at 5.30.—Experimental Phonetics and its Utility to the Linguist: D. Jones.

ROYAL ASTRONOMICAL SOCIETY, at 5.—Anniversary Meeting.

MALACOLOGICAL SOCIETY, at 7.—Annual Meeting. Presidential Address: Systematic List of the Marginellidæ: J. R. le B. Tomlin.

PHYSICAL SOCIETY, at 5.—A Special Test on the Gravitation Temperature Effect: Dr. P. E. Shaw and C. Hayes.—To Measure Pressure in a High Vacuum by Observation of Logarithmic Decrement: Dr. P. E. Shaw.—Note on the Calculation of the Coefficient of Diffusion of a Salt at a Definite Concentration: Dr. A. Griffiths.

SATURDAY, FEBRUARY 10.

CERAMIC SOCIETY, at 7.—Acid and Basic Furnace Lining.

MONDAY, FEBRUARY 12.

ROYAL SOCIETY OF ARTS, at 4.30.—Town Planning and Civic Architecture: Prof. A. Beresford Pite.

TUESDAY, FEBRUARY 13.

ROYAL INSTITUTION, at 3.—Pain and its Nervous Basis: Prof. C. S. Sherrington.

WEDNESDAY, FEBRUARY 14.

ROYAL SOCIETY OF ARTS, at 4.30.—Highways and Footpaths: Lawrence Chubb.

THURSDAY, FEBRUARY 15.

ROYAL SOCIETY, at 4.30.—*Probable Papers*: Structure and Development of the Tubular Enamel of the Sparidæ and Labridæ: Dr. J. H. Mummery.—(1) Distribution in Wheat, Rice and Maize Grains of the Substance the Deficiency of which in a Diet causes Polyneuritis in Birds and Beriberi in Man. (2) Effect of Exposure to Temperature at or above 100°C upon the Substance (Vitamine) whose Deficiency in a Diet causes Polyneuritis in Birds and Beri-beri in Man: Harriette Chick and E. M. Hume.

ROYAL INSTITUTION, at 3.—The Mechanism of Chemical Change: Prof. F. G. Donnan.

SOCIETY OF GLASS TECHNOLOGY, at the University, Western Bank Sheffield, at 4.30.—The Annealing of Glass: F. Twyman.

ROYAL SOCIETY OF ARTS, at 4.30.

INSTITUTION OF MINING AND METALLURGY, at 5.30.—The Wet Assay of Tin Concentrate: H. W. Hutchin.—Hydraulic Tin Mining in Swaziland: J. Jervis Garrard.

FRIDAY, FEBRUARY 16.

ROYAL INSTITUTION, at 5.30.—Authors' Dedications in the Seventeenth Century: The Dean of Durham.

INSTITUTION OF MECHANICAL ENGINEERS, at 6.—Annual General Meeting.

GEOLOGICAL SOCIETY, at 3.—Annual General Meeting.

SATURDAY, FEBRUARY 17.

ROYAL INSTITUTION, at 3.—The Mystery of Counterpoint: Dr. H. Walford Davies.

CONTENTS.

	PAGE
Sea-trout. By **C. T. R.**	445
Photographic Recording. By **C. J.**	445
Our Bookshelf	446
Letters to the Editor:—	
The Aurora, Magnetic Storm, and Sun-spot of January 4.—**Rev. A. L. Cortie, S.J.**	446
Forms of Weathering in Magnesian Limestone. (*Illustrated.*)—**George Abbott**	447
Tertiary Igneous Rocks of the Pyrenees.—**P. W. Stuart-Menteath**	448
The American Association for the Advancement of Science	448
Research in Timber	450
otes	451
Our Astronomical Column:—	
The Lake Okechobee Meteorite	455
Cluster Variables	455
United States Naval Observatory	455
International and Natural Law	455
Forthcoming Books of Science	456
Research in Industrial Laboratories	458
University and Educational Intelligence	461
Societies and Academies	462
Books Received	464
Diary of Societies	464

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

Advertisements and business letters to be addressed to the Publishers.

Editorial Communications to the Editor.
Telegraphic Address: PHUSIS, LONDON.
Telephone Number: GERRARD 8830.