THURSDAY, JULY 10, 1919.

PRODUCTIVE DUALITY.

(1) *Strife of Systems and Productive Duality: An Essay in Philosophy.* By Prof. W. H. Sheldon. Pp. x + 534. (Cambridge, Mass.: Harvard University Press; London: Humphrey Milford, Oxford University Press, 1918.) Price 15*s*. net.

(2) *Self and Neighbour: An Ethical Study.* By Edward W. Hirst. Pp. xx + 291. (London: Macmillan and Co., Ltd., 1919.) Price 10*s*. net.

THE idea, deeply ingrained in our intellectual nature, that the constituents of reality, could we only discriminate them, would be found to be single and simple is neither borne out nor supported by any actual research, scientific or philosophical. We are for ever asking what a thing is, and for ever surprised that the only answer we can get is in terms of what a thing does. Doing implies process, process means activity, and the concept of activity involves the idea of opposition within the concept itself.

(1) Prof. Sheldon, in his interesting survey of the strife of systems, has made a bold application of this fact to the problem of philosophy. He presents difficult problems in a pleasant, flowing style which is itself a source of pleasure to the reader. The thesis which he defends is that the lack of unity in philosophy and the tendency of philosophical systems to present sharp antagonisms, far from being, as is so often urged by critics, a scandal of reason, are the very conditions of progress. It is no new doctrine; it is, in fact, the well-known Hegelian theory of the dialectic, according to which the advance of thought is through contradiction and pure negation to new affirmation and a higher synthesis. Prof. Sheldon proposes, however, a bold application of the principle which would bring within it the Hegelian philosophy itself as one of the systems in strife. This antagonism does not merely concern human systems of thought. "The deepest trait of reality, that which makes it the moving, productive thing it is, is just the marriage of two principles whose apparent hostility has constituted the continual frustration of man's effort to map the universe."

(2) Mr. Hirst deals with this strife of systems in the ethical sphere. It is not difficult to understand why at the present time there is a lively interest in the ethical problem. Human society is undergoing a reconstruction so fundamental that the chance seems now offered to reformers to make actual and practical ideals which a few years ago seemed remote and visionary and possible of realisation only by steady and persistent perseverance in the course of generations. The millennium, it is true, loses its æsthetic charm as a vision when it becomes plain matter of fact; none the less, the widespread feeling at the present time that, whatever the outcome of our social reconstruction, we are at least enjoying an opportunity such as few now living could have expected to see is setting its stamp on our speculative thought.

Practical reformers are not usually tolerant of the speculative theorists, and the reason is not far to seek. If the science of political economy has earned for itself the epithet "dismal," the science of ethics most certainly deserves the epithet "dull." Nowhere in the whole scheme of philosophy and science does there seem to be such laborious effort combined with such discouraging flatness as in the sphere of speculative ethics, and yet theoretically ethics is the culminating interest in philosophy. Mr. Hirst's "Ethical Study" cannot escape this condemnation, although it makes a brave attempt. It lacks vision and has no audacity. It discusses the problem along the well-worn lines of the attempt to reconcile egoism and altruism. It contains a good deal of critical exposition of modern theories, particularly those of the late T. H. Green and the present Bishop of Down, and it is very sympathetic towards Dr. Rashdall's "Theory of Good and Evil." It is in the exposition of these writers that the ethical interest of the book centres. The criticism of the earlier classical writers is inadequate, and the quotations are so often at one or even two removes that an uncomfortable doubt creeps in as to the author's acquaintance with the original. And when we are told that "we owe to Plato one of the greatest literary works, in which he sketched the constitution of an ideal society," we wonder what class of readers the author has in mind! The one contemporary philosopher who really may be said to have raised the problem of ethics to a higher plane, Benedetto Croce, is not mentioned, and possibly the "Philosophy of Practice" is as yet unknown to the author. Croce's distinction between economic and ethical conduct in that treatise appears to the present writer to have placed the ethical problem in a new setting and altered the conditions on which it will in future be discussed.

Mr. Hirst's book is not confined to ethics; we are soon switched on to pure psychology, and then from psychology to pure metaphysics. The author is thoroughly at home in the most recent philosophical literature in England, and his work is extremely well-informed and instructive. Though he freely expresses his agreement or disagreement with the various theories he notices, we never get a clear expression of his own view developed independently. It is this we should like to have, and the disappointment with which we close the book in not having got it is perhaps the highest praise the author can wish for as regards the interest his book arouses.

H. W. C.

TEXT-BOOKS OF CHEMICAL ANALYSIS.

(1) *A Systematic Course of Qualitative Chemical Analysis of Inorganic and Organic Substances, with Explanatory Notes.* By Prof. Henry W. Schimpf. Third edition, revised. Pp. ix+187. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1917.) Price 7*s*. net.

(2) *Essentials of Volumetric Analysis: An Introduction to the Subject, Adapted to the Needs of Students of Pharmaceutical Chemistry.* By Prof. Henry W. Schimpf. Third edition, re-written and enlarged. Pp. xiv+366. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1917.) Price 7*s*. net.

(3) *An Advanced Course in Quantitative Analysis, with Explanatory Notes.* By Prof. Henry Fay. Pp. vi+111. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1917.) Price 6*s*. net.

(1) THIS volume is intended especially for pharmaceutical students, and the author has borne in mind the fact that such students can devote but a relatively short time to the study of analytical chemistry. Hence the endeavour has been made to confine the work to those qualitative chemical reactions, both organic and inorganic, which it is considered essential for students of pharmacy to master. An ample course has been provided; but the book is frankly didactic rather than educative.

In carrying out the scheme, much use is made of "charts" and tables of procedure, not only for the analysis of mixtures, but also for examining simple salts. A useful feature is the plentiful employment of equations in explanation of the reactions: this is a matter on which the average student is often weak. Although the "organic" part of the work has been written in reference to the United States Pharmacopœia, it will be found quite serviceable by students in this country. The matter is both well arranged and well printed.

In a work of this character there seems to be no sufficient reason for including a section dealing with elementary chemistry (atoms, valency, symbols, salts, etc.). The sixteen pages devoted to it cannot take the place of an ordinary chemical text-book; and that being so, they might be more profitably devoted to analytical matters. It may be noted that, in the chart on p. 72, *sodium* metantimonate, instead of the potassium salt, is, by an oversight, shown as the reagent to be used in testing for sodium.

(2) Like the foregoing work, this volume is also designed for the use of pharmaceutical students. Hence, in addition to descriptions of the general principles of volumetric analysis, chapters are included which initiate the user into methods of dealing with medicinal substances. Such methods are, for instance, those used in the estimation of alkaloids volumetrically, and in the assaying of vegetable drugs and galenical preparations. With these may be mentioned the processes used for the determination of phenols, nitrites, sugars, and alcohol; assays of drugs, such as chloral and resorcinol, and the examination of oils, fats, and waxes. The chapters in question will be found to be excellent introductions to these parts of the subject.

The earlier chapters give good explanations of the general principles and practice of volumetric analysis. They are provided with numerous worked-out examples to explain the calculations involved.

Whilst, however, the book, on the whole, will be found convenient and useful, it would be improved here and there by a revision of the wording. Such sentences as "the sensitiveness of the indicators and its colour changes is ascribed to . . ." (p. 21) do not well express the author's meaning. The revision of proofs, too, might have been better done. Thus the statement that "oleomargarin requires about one mil of beef-fat" (p. 285) will be found rather cryptic by the student, until he realises that somehow or other "decinormal alkali" has been transformed into "beef-fat" during its passage through the press.

(3) Work of a rather advanced kind, suitable for students who have already gone through a good introductory course, is provided in this third volume. The subjects chosen are such as to afford experience in the methods used for assaying minerals and metals. The analysis of silicates is first dealt with, and this is followed by that of spathic iron ore, pyrites, and titanium iron ore. After a few more exercises, including the proximate analysis of coal, the student is taken on to the analysis of phosphor-bronze and the determination of the numerous substances present in various kinds of iron and steel. These examples will indicate the nature of the experimental work to be carried out. Except as regards coal, the estimations are concerned with inorganic substances only.

A notable feature of the book is Prof. Fay's explanatory notes, which will be found very helpful, as will also the original references provided. The methods of analysis used are such as would be employed in actual working practice, and the book can be cordially recommended to the notice of advanced students and their tutors.

THE VALUE OF A GARDEN.

A Garden Flora: Trees and Flowers Grown in the Gardens at Nymans. By L. Messel. 1890–1915. With illustrations by Alfred Parsons. Foreword by William Robinson. Notes by Muriel Messel. Pp. ix+196. (London: *Country Life* Offices and George Newnes, Ltd.; New York: Charles Scribner's Sons, 1918.) Price 10*s*. 6*d*. net.

THE garden at Nymans, Sussex, is without doubt a particularly favoured spot. It rises to some 500 ft. above sea-level, and has a good loam soil overlying sandstone. As might be expected from such a soil, the garden contains a wealth of rhododendrons and heaths and other interesting plants which only flourish where chalk is absent from the soil.

The remarkable list of the plants grown in the garden which the late Miss Messel has drawn up, to the memory of her father, Mr. L. Messel, the founder of the garden, is not only a splendid tribute to one who took the keenest interest in the cultivation of all that was rare and interesting, but also a most valuable work for all true garden-lovers.

The book enumerates all the plants grown at Nymans, a sufficiently remarkable collection to warrant its publication, and its value is much enhanced by the notes added by Miss Messel about the plants of more especial interest. Particulars as to the hardiness of numerous tender plants grown in the garden are also given, and all those that are half-hardy or doubtfully hardy, as well as those grown under glass, are specially marked.

The volume, which is beautifully printed on excellent paper, is enriched by the drawings of Mr. Alfred Parsons of plants which have flowered in the garden. So good are these that one would have welcomed some more from his accomplished pencil.

One reads through the lists of plants with envy, especially when the sizes of some of the more tender plants are noted. To find *Embothrium coccineum, Berberidopsis corallina, Abutilon vitifolium,* and four species of Acacia, among other tender plants, flowering out of doors so near London is remarkable.

One reason of Mr. Messel's success, with plants which are not usually considered hardy, was that he grew such plants with some protection during the winter, until they were large enough and strong enough to plant in the open. Had they been put out as small plants the failures would have been numerous.

In the appendix a list of the plants killed or severely damaged during the winter of 1916–17 is given. On the whole, the casualties are remarkably small, and it is particularly interesting to notice the somewhat unexpected survivors of the severe winter.

It is with great regret that we have to record the death of Miss Messel in December last from influenza.

OUR BOOKSHELF.

Electro-Analysis. By Prof. Edgar F. Smith. Sixth edition, revised and enlarged. Pp. xiv + 344. (Philadelphia: P. Blakiston's Son and Co., 1918.) Price 2.50 dollars net.

AT one time electro-analysis did not find much favour among chemists, because an analysis required too long a time, too complicated apparatus, and too much platinum. These objections have to a great extent been removed, largely through research by Prof. Edgar F. Smith, whose rapid precipitation of metals by the method of the rotating anode, introduced in 1901, has overcome the difficulty of time. Also of particular importance is his double mercury cup, the usefulness of which has been greatly enhanced by recent improvements described in the present edition of this book. The principle of this double cup is the same as that of the Castner-Kellner caustic soda plant. Remarkable success has attended the application of this method, not only to the complete analysis of single salts, such as sodium chloride, but also to the effecting of certain difficult separations, such as that of the alkali metals from one another.

Apart from a short chapter on "Theoretical Considerations," this book is entirely devoted to practical details, which are very fully given. Nevertheless, the author speaks with the confidence of one who has acquired his knowledge by actual experience, and has researched for more than forty years untrammelled by any electrochemical theory, whether of ions or of potentials.

The rareness among analysts of familiarity with electricity still remains a serious obstacle to progress in electro-analysis, and will remain so as long as electricity receives the little attention at present given to it by the chemist-in-training. If we have in view both speed and accuracy the best procedure in analysis is neither purely chemical nor purely electrical, but comprises a judicious blending of the two methods, and for guidance in electro-analysis every chemist should have a copy of the present standard work.

FRANCIS W. GRAY.

The Journal of a Disappointed Man. By W. N. P. Barbellion. With an introduction by H. G. Wells. Pp. x + 312. (London: Chatto and Windus, 1919.) Price 6*s.* net.

THERE have before now been clever young men who by their own efforts have conquered circumstance and won distinction in science, but, thank goodness, none of them has ventured to publish his high opinion of his own merits and his contempt for his neighbours, if not for the rest of mankind. Had he kept his own counsel, like the rest of us, Barbellion would doubtless have passed for a bright boy-naturalist, a student of zoology deserving all encouragement, and an amiable colleague when by hard work he won a post at the Natural History Museum. One would have recognised his brains, originality, and power of presentation, and one might have regretted to see another promising morphologist pinned for life to systematic entomology. His restless energy might have moulded to his own fashion that cramping environment, or might have raised him above it, had it not been for the slow and fatal disease against which he was struggling from the first. For that tragedy, for his courage and humour, and for his unquenched love of Nature, which here finds beautiful though rare expression, we can forgive his self-love, self-pity, and self-exposure, and place his journal on our shelf next that of Marie Bashkirtseff.

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.*]

Military Camouflage.

ARTICLES on military camouflage have frequently appeared in both scientific and popular journals, but the picture drawn is invariably very different from the reality as seen by those who made the camouflage. The following remarks attempt to correct some of these inaccuracies by setting out as clearly as possible the conditions under which the military camoufleur worked.

Military information is obtained by horizontal observation from first-line trenches, by horizontal and oblique observation from kite-balloons, and by vertical observation from aeroplanes. Horizontal observation has a limited field of a few miles, whereas vertical observation is limited only by the distance an aeroplane can cover and return. The latter is thus of much the greater importance, especially because with the aid of photography very much greater detail can be obtained than by direct observation.

Even in forward areas open to horizontal observation camouflage requires to be proof against aerial photography. What escapes the long-focus camera carrying rapid and fine-grained plates will be passed by the eye even aided by optical instruments.

An example will illustrate most of the governing factors. Suppose that it has been decided to conceal a machine-gun emplacement by an artificial haystack. Either it must take the place of an existing stack or recently cut grass must account for its sudden appearance in the photograph. The comparison of photographs taken at different dates was a routine practice. The artificial stack must be of the size and form of haystacks of the neighbourhood; any defect in these respects would be recognised photographically by measurement of its cast shadow or by exaggerated stereoscopic examination. Any two photographs taken from about the same height suffice for stereoscopic examination.

If the stack be made of artificial material, such as canvas, and matched in colour to the eye, it may be discovered by the use of colour-filters or plates sensitive to special regions of the spectrum. The Germans used a very rapid plate the sensitiveness of which was almost confined to the green region. To ensure that the colour composition of the artificial was not at fault, it is best to use hay or straw in its construction. This is best for another reason in order to copy so far as possible the texture of the natural, for under the changing angles of illumination in Nature it is not possible to match constantly a rough surface by a smooth artificial, and this difference is likely to be seen sooner or later by the reader of aerial photographs. It is clear, therefore, that to defeat the aerial camera an exact copy is required. Amongst animals such concealment is comparable with that of Kallima, the leaf-butterfly. What may be termed impressionistic methods commonly found in animal coloration are quite useless for the defeat of the reader of aerial photographs. For concealment against horizontal observation the same methods had to be employed, as the object is constantly being scrutinised by many eyes, aided by binoculars, colour-filters, etc., exercising systematic observation, as well as being subject to vertical observation. An observation post in a sandbag parapet had to be concealed by a wire-gauze screen modelled to resemble exactly the sandbag removed for the purpose.

Many military objects were successfully concealed by erecting flat covers over them. These were made of fish- or wire-netting threaded with strips of canvas painted green or brown, according as to whether the surroundings were grass or earth. The paints used were made to give as nearly as possible the same colour-composition as grass, earth, etc. The required texture was obtained by leaving the ends of the canvas strips long. The cast shadow was concealed by gradually thinning out the canvas strips towards the edge, so that no defined shadow was cast. Under such covers, and more especially on rough ground, guns and other military objects were successfully concealed. This is, again, a case of exact copying except for the cast shadow, which is concealed by thinning out the edge in a manner similar to the standing coats and serrated edges of some animals.

The difficulty of concealing guns was greatly increased because they could be located with considerable accuracy by flash-spotting and sound-ranging, though to pin-prick them on the map detection by aerial photography was required. Still, these other methods of detection narrowed down the area to be examined often to the size of a halfpenny.

Further, the reader of aerial photographs became very skilled in detecting the presence of concealed objects from signs, tracks, moved earth, unusual agricultural activities, activities along roads and rails, and in many other places distant from the object, so that a camouflaged object was likely to be subject to the minutest examination and the smallest defect unlikely to be overlooked.

Meticulous care in the smallest detail was, therefore, essential, especially because a detected camouflage gave a false security. The degree in which accuracy was necessary may be conveyed by the following example. An attempt was made to represent a light-railway track by dark lines painted upon canvas, the canvas representing ballast. The painted rail was not so dark in the photograph as the real rail. It was found essential to make a raised rail of rope and canvas in order to cast the same shadow as a steel rail.

Unfortunately, especially during the early stages of the war, commanding officers often did their own camouflaging. This work almost invariably consisted of imitative painting, generally of an exceedingly childish kind, or, on the other hand, they succeeded in making the object more conspicuous by the use of conventional patterns in gaudy colour. In fact, painting for land camouflage was of no value except possibly to lower the reflection at night from, say, a hospital roof by the use of dark green or black paint when no texture was available. It is from the work carried out without technical advice from the Camouflage Corps that the public has been led astray, and it is to counteract this incorrect impression that the foregoing description may be of value.

ADRIAN KLEIN.
J. C. MOTTRAM.

Question Relating to Prime Numbers.

THE reply to Mr. Mallock's inquiry in NATURE of June 19 is that if n denotes the m^{th} prime number (counting from unity), then the ratio of m to $n/\log_e n$ tends to unity as m tends to infinity. It follows that an approximate expression for n is $m \log_e m$.

These results (known as the prime number theorem) were conjectured by Legendre, and were first proved about a quarter of a century ago by Hadamard and by de la Vallée Poussin. References to the somewhat extensive literature on the subject will be found in Landau's "Handbuch der Primzahlen."

It would be of interest if Mr. Mallock would construct the graph for the function $m \log_e m$ which corresponds with the graph given on p. 305.

G. N. WATSON.

The University, Birmingham.

LORD RAYLEIGH, O.M., F.R.S.

THOUGH any adequate account of Lord Rayleigh's contributions to science will require time and extend far beyond the limits of a short article, the loss of one who has so long been their leader cannot be passed over by physicists without some immediate attempt at an appreciation and acknowledgment of the discoveries he made and the services he rendered to science.

For more than fifty years Lord Rayleigh put forth without any interruption and without a trace of diminution in quality or quantity a succession of researches covering almost every branch of the older physics. As the five volumes of the "Collected Papers," which only include those down to 1910, contain 349 papers, he must during his career have published nearly 400 papers; not one of these is commonplace, and there is not one which does not raise the level of our knowledge of its subject. Collected papers are apt to form a kind of memorial tablet in our libraries to men of science, but, if I may judge from my own experience, Rayleigh's are a remarkable exception; there are few, if any, books which I consult more frequently than these volumes and from which I derive greater delight and benefit. No small part of this is due to the clearness and finish with which they are written.

Rayleigh had, like Kirchhoff, the spirit and feeling of the artist in the preparation and presentation of his papers. His mathematical analysis seemed to flow naturally into the most concise and elegant form, and, whatever might be the difficulty of the subject, it was never increased by any obscurity or ambiguity as to the meaning of the writer. This quality was so ingrained that it could resist the rush and excitement of a competition as keen as that of the Mathematical Tripos; for when he was Senior Wrangler in the Tripos for 1865 one of the examiners said: "Strutt's papers were so good that they could have been sent straight to press without revision."

Another feature brought out by this collection of papers is their catholicity. The papers are indexed under the headings Mathematics, General Mechanics, Elastic Solids, Capillarity, Hydrodynamics, Sound, Thermodynamics, Kinetic Theory of Gases, Properties of Gases, Electricity and Magnetism, Optics, Miscellaneous; and there is such a goodly array under each of these headings that it is difficult to decide in which branch of physics his work was the most important. Rayleigh once said to me that he sometimes speculated whether he would not have done better to concentrate on a more limited field. Probably, however, in these matters one's mind takes the bit between its teeth and chooses the path in which it can work to the best advantage.

Whatever may be the subject of the paper, some characteristics are always apparent. One of these is the quite exceptional power Rayleigh possessed of seeing what was the essence of the question; he always went straight for the critical spot. Another—perhaps to a considerable extent the result of the last—was the remarkable gain in clearness any subject acquired after it had passed through his mind, which was like a filter which cleared every subject passing through it from obscurity and error. He seemed to delight in encountering and clearing away difficulties, and had a high opinion of the value of difficulties in helping one to get a better grip of the subject. Once, in speaking to me about one of the extraordinarily few cases in which later investigators had arrived at results appreciably different from his, he laid great emphasis on this point, and said that the investigation in question was one of the very few in which from beginning to end he had not been conscious of any difficulty. Another characteristic was the soundness of his judgment. I question if in this respect he has ever been surpassed; his mind was crystalline, not affected by any cloud of prejudice; he did not dislike or shy at an idea because it was new, neither did he think that because it was new it was necessarily better than the old.

To pass to the discoveries and results contained in these papers, there are such a multitude of high peaks that it seems almost invidious to single out any for special mention. In optics we have the series of papers on the scattering of light by small particles, and the proof that the molecules of air are sufficiently large and numerous to account for the colour of the sky. The study of this subject Rayleigh resumed from time to time, and it has of late been taken up from the experimental side with great success by his son. Other noteworthy papers on optics are his researches on the resolving power of optical instruments and on the nature of white light. His article on light in the "Encyclopædia Britannica" is remarkable for clearness of exposition and novelty of outlook. The paper on the resultant amplitude of vibrations of the same period and arbitrary phase, though written primarily for its optical application, has proved of great importance in connection with the scattering of rapidly moving particles and with the phenomena of viscosity and diffusion.

In hydrodynamics we owe to Rayleigh the theory of the formation and stability of jets; researches in capillarity of fundamental importance; the theory of the stability of motion in viscous fluids; the theory of the resistance experienced by a plane when moving through a liquid, with its application to the theory of flight, a subject in which he took great interest, and in which he was a pioneer. His book on the "Theory of Sound" may be said to have found the subject bricks and left it marble; it is ideal from the point of view of a text-book and also as a record of original research. In general dynamics we owe to him great extensions in the application of the principle of reciprocity, and researches on the general theory of vibrations of dynamical systems and on the partition of energy. All these researches present a perfect amalgamation of physical principles and mathematical analysis; the physics guides and directs the analysis, while the analysis gives definiteness and point to the physics.

On the more purely experimental side we recall Rayleigh's classical determination, made mostly in co-operation with Mrs. Sidgwick when he was Cavendish professor, of the absolute measure of the fundamental units of electricity. Among the experimental researches is the one by which he is most widely known and in which he perhaps opened up the newest ground—the discovery of argon. As an inadequate estimate of the part Rayleigh took in this discovery is not uncommon, it may be as well to recall the facts relating to it. In a letter to NATURE in 1892 he said he had been much puzzled by the difference between the density of the nitrogen obtained from the air and that obtained from compounds of nitrogen. The latter was always considerably lighter. He followed this up by a paper, published in 1894, in which he showed that there was no variation in the density of nitrogen prepared from different nitrogen compounds, so that this must be regarded as true nitrogen, and that the heaviness of the nitrogen obtained from the air must be due to the presence of a heavier gas; it was shown in this paper that this gas could not be any of the gases known to chemists. This view was not universally accepted by chemists, convincing as the evidence was, for it seemed to some of them incredible that the atmosphere contained large quantities of a gas which had quite escaped dilution.

In his search for this gas Rayleigh was fortunate enough to secure the co-operation of Sir William Ramsay, and their joint work was so successful that at the meeting of the British Association in Oxford in 1896 they were able to announce the discovery that the air contained about ½ per cent. of a new gas, argon. This gas proved to have remarkable properties and to belong to a new family in the chemical elements, many other members of which were afterwards discovered by Sir William Ramsay. Though both shared in running down the hare, it was Rayleigh alone who started it, and this not by a happy accident, or by the application of new and more powerful methods than those at the disposal of his predecessors, but by that of the oldest of chemical methods—the use of the balance.

A remarkable feature of Rayleigh's experimental work was the simplicity of the apparatus with which the results were obtained; it has been said of him that he needed nothing for his experiments but some glass tubing and a few pieces of sealing wax. The many Continental and American physicists who visited Terling were filled with amazement that such important results could have been obtained with such simple apparatus. His example shows that, provided you can "mix your colours with brains," there are still regions in physics in which good work can be done with modest appliances; at the same time, it is true that there are other regions in which time would be wasted unless powerful and elaborate appliances were available.

Though Rayleigh's activities were mainly engaged with research, he did very important work in other fields. He held from 1879 to 1884 the Cavendish Professorship of Experimental Physics at Cambridge—there seemed something peculiarly appropriate in his holding a professorship with this title, for the work of Cavendish and Rayleigh had many characteristics in common. While at Cambridge he not only made the determinations of electrical constants already alluded to, but in conjunction with Glazebrook and Shaw he also organised the teaching of theoretical and practical physics, and made for the first time the laboratory take an integral part in the training of students of science. The writer, who was a pupil of his at Cambridge, remembers well the assistance he gave to those working in the laboratory, and how greatly a talk with him cleared up one's notion of a subject and helped to overcome difficulties.

Rayleigh was for eighteen years professor of natural philosophy at the Royal Institution, and was scientific adviser to the Elder Brethren of Trinity House. He had been secretary and afterwards president of the Royal Society, and since 1908 Chancellor of the University of Cambridge. He took the keenest interest in the formation and development of the National Physical Laboratory; he was chairman of the executive committee from the beginning until a few months before his death, and his interest, advice, and influence have played a very large part in securing the success of that institution. He was a member of the Advisory Council for Scientific and Industrial Research, and as chairman of the Committee for Aeronautics rendered great service to the progress of aviation. Throughout the war his advice was of much assistance to many committees engaged in the applications of science to naval and military purposes.

Though Rayleigh disliked even more than most men the loss of time inseparable from attendance at committees and meetings, he took his full share of such work, and it has been a great thing for British science to be able to call to its councils a man whose judgment was never influenced by prejudice or by a shadow of self-seeking.

J. J. T.

JOHN WILLIAM STRUTT, third Baron Rayleigh, was born in Essex on November 12, 1842, and succeeded his father in the title in 1873. He was educated at Trinity College, Cambridge, taking his degree as Senior Wrangler in 1865. His immediate neighbours in the Tripos list were Prof. Alfred Marshall and Mr. H. M.

Taylor. The same year he obtained the first Smith's prize, and in 1866 became a fellow of his college. He married Evelyn, daughter of Mr. James Maitland Balfour, of Whittingehame, and sister of Mr. A. J. Balfour, the Foreign Secretary. Of his four sons two survive him—Robert, now professor of physics in the Imperial College of Technology, who succeeds to the title; and Arthur, who for a great part of the war was navigating officer on the flagship of the 1st Battle Squadron. They, with their mother, were present at their father's funeral, which took place at Terling on Friday last.

For some years after his marriage Lord Rayleigh lived at Terling. During this period he wrote a number of papers, which at once secured for him a position as a leader in physical science.

The Cavendish professorship of physics was established in 1871, and Maxwell became the first professor. On Maxwell's death in 1879 Lord Rayleigh was invited to return to Cambridge as professor and carry on the work of equipping the Cavendish laboratory, which had been built and fitted by the generosity of the seventh Duke of Devonshire, then Chancellor, and of establishing a school of physics in the University. He had served as examiner in the Mathematical Tripos of 1876, and had been in touch with the developments then proceeding in Cambridge. He retained the professorship until 1884, when he resigned, and was succeeded by Sir J. J. Thomson. The same year he visited Montreal as president of the British Association on the occasion of its first meeting outside the British Isles. From 1887 to 1905 he was professor of natural philosophy in the Royal Institution, and from 1887 to 1896 secretary of the Royal Society. He held the office of president from 1905 to 1908, and in the latter year succeeded the late (eighth) Duke of Devonshire as Chancellor of the University of Cambridge, an office he retained until his death.

In 1896 he became scientific adviser to the Trinity House. About the same time, as the result, in great measure, of discussions at the British Association meetings at Ipswich (1895) and Liverpool (1896), a scheme for a National Physical Laboratory took form, and Lord Rayleigh became chairman of a Treasury Committee appointed by the late Lord Salisbury to consider and report on the question. The Committee reported in 1898 in favour of establishing the laboratory as a "public institution for standardising and verifying instruments, for testing materials, and for the determination of physical constants." Lord Rayleigh was appointed by the Royal Society as chairman of the executive committee to which the management of the laboratory was entrusted, and retained the office until a few weeks ago, when failing health compelled him to resign.

In 1908 an important International Conference on Electrical Units was held in London, and Lord Rayleigh presided over its deliberations, which have since had very important results.

About the same time the importance of research in aeronautics began to be realised, and he was consulted by Mr. Haldane, then Secretary of State for War, as to the best method of enlisting the help of men of science in promoting flight. The appointment of the Advisory Committee for Aeronautics was the result; Lord Rayleigh became its first president in 1909, and continued to hold the office until very shortly before his death.

His advice was sought by successive Governments on very various scientific matters. He was for some time a member of the Explosives Committee; he also held the appointment of gas referee for the metropolis. The Department of Scientific and Industrial Research was established in 1917, and Lord Rayleigh became one of the first members of the Advisory Council appointed to advise the Minister in charge of the Department on scientific and technical questions. His work was recognised by his contemporaries both at home and abroad. He was one of the first members of the Order of Merit and a Privy Councillor.

In 1904 he was awarded the Nobel prize. From the Royal Society he received the Copley, the Royal, and the Rumford medals; he was an honorary fellow of Trinity College, Cambridge, a doctor of science of many universities, an Officer of the Legion of Honour, foreign member of the Institute of France, and an honorary or corresponding member of numerous other learned societies both at home and abroad.

Such is the very brief record of the life of a great Englishman, by whose death, at the ripe age of seventy-six, the world has lost immensely. His earlier papers were published at the beginning of the seventies of last century; the *Philosophical Magazine* for May, 1919, contains what is probably his last paper—"On the Resultant of a Number of Unit Vibrations over a Range not Limited to an Integral Number of Periods."

For some fifty years Lord Rayleigh worked and added to the sum of human knowledge, and though he had passed the allotted span of life and was approaching the age of four-score years, yet was his strength then not labour and sorrow, for he retained to the full the power of clear thinking, the firm grasp of first principles, and the ability to appreciate almost at first sight the essentials of any problem that appealed to him which had made him great. "The works of the Lord are great, sought out of all them that have pleasure therein," is the motto he prefixed to his five volumes of collected papers. Few men have done more to seek out and make clear the laws of Nature; few have taken more pleasure in their task or helped more wisely to smooth the path of those who follow in the search.

This is not the opportunity to give any detailed account of that work; perhaps it is scarcely necessary. Lord Rayleigh's papers up to 1910 have been collected by the Cambridge University Press and issued under his own editorship in five volumes. It is to be hoped another volume may be added to complete the work up to the present day. This is all the more desirable as it will afford an opportunity of putting on record his work as president of the Advisory Committee for Aeronautics. Many of the investigations of the Committee have rested on the principle of similarity, which in its application to the problems of flight was first clearly explained by him in one of the earlier volumes of its reports.

For the rest, reference may be made to two reviews of the volumes of "Scientific Papers" which appeared in these columns for July 30, 1903, and October 23, 1913; in these and in the article published in the series of "Scientific Worthies" in NATURE of August 18, 1904, some account of Lord Rayleigh's work is given. A quotation from the first-named article may perhaps be made here. After referring to a paper dealing with the measurement of electrical resistance, the article continues: "The paper exhibits in a marked degree Lord Rayleigh's great capacity for seeing distinctly the essential points of an experiment or a measurement, and keeping that clearly in view throughout. This, indeed, is the distinguishing feature of his experimental work, a main factor in his success. Those who knew the Cavendish Laboratory when the electrical measurements were going on or have since visited the laboratory at Terling, from which no less important work is continually being published, have sometimes been surprised at the makeshift character of much of the apparatus. Contrivances of wood and wire and wax do duty where most men would use apparatus elaborated with a quite unnecessary care; but in Lord Rayleigh's case, while the essential instrument on which the accuracy of the result really depends is as perfect as the skill of the workman can make it, and, in addition, has been thought out in all its details, so as to fit it best for the purpose immediately in view, for the rest the arrangement which comes first to hand is utilised without regard to appearances."

The last of the great Cambridge mathematicians of the past century, Cayley, Adams and Stokes, Maxwell and Kelvin, Lord Rayleigh was one of the famous men praised by the writer of the book of Ecclesiasticus: "Leaders of the people by their counsels, and by their knowledge of learning meet for the people, wise and eloquent in their instructions. . . . Their bodies are buried in peace; but their name liveth for evermore." R. T. G.

IT is now nearly sixty years since the Hon. J. W. Strutt, eldest son of the second Baron Rayleigh, entered Trinity College, Cambridge, to study for the Mathematical Tripos. The Lucasian Professor of Mathematics, G. G. Stokes, was at the time engaged in working out the laws of fluorescence and in writing his report on "Double Refraction" for the British Association; Prof. W. Thomson, of Glasgow, had published his great paper on "The Dynamical Theory of Heat"; Prof. J. C. Maxwell, of King's College, London, was writing those fundamental papers on "Electrodynamics" which were incorporated in his "Electricity and Magnetism"; and Balfour Stewart, of the Kew Observatory, had laid the foundations for the modern laws of radiation. The new undergraduate became Senior Wrangler and first Smith's Prizeman in 1865, and next year was elected to a fellowship. His first scientific paper, published in 1869, illustrated electrodynamic laws by comparison with those of mechanical models, a method much used by Maxwell in his own papers. Next year his paper on "Resonance" appeared, and this was the forerunner of a long series of experimental and theoretical papers on vibrations in general, which, when embodied in his "Theory of Sound," made that work unique.

In 1871 the Cavendish Professorship of Experimental Physics was founded at Cambridge, and, urged by Strutt, Maxwell became the first holder of the chair. In 1873 Strutt succeeded his father as Baron Rayleigh, and on the death of Maxwell in 1879 became Cavendish professor. During the intervening years his scientific work had been chiefly in optics and hydrodynamics, and he had published important papers on waves and on diffraction gratings, while at the Cavendish Laboratory his experimental work consisted mainly in a continuation of the determinations of electrical standards inaugurated by Maxwell as a member of the Electrical Standards Committee of the British Association. Working, in the first instance, with Dr. Schuster, and afterwards with Mrs. Sidgwick, he showed that the B.A. ohm was 1 per cent. too small, and established values for the electrochemical equivalent of silver and for the electromotive force of the standard Clark cell, which have been confirmed by more recent measurements. Under the instigation of Lord Rayleigh, other determinations of fundamental importance were made in the laboratory, such as J. J. Thomson's work on the number of electrostatic units in the electromagnetic unit, and Glazebrook's on the B.A. ohm.

In addition to his work on electrical standards, Lord Rayleigh continued his acoustical observations, and took up the subject of surface tension and its influence on the behaviour of jets. He resigned the Cavendish professorship in 1884, having during his five years' tenure of the office contributed fifty papers to the advance of science. During the next three years his researches were mainly on optics and on electricity In 1887 he became a secretary of the Royal Society and professor of natural philosophy at the Royal Institution, holding the former office until 1896, and the latter until 1905. His lectures at the Royal Institution invariably showed how thoroughly he was master of any subject he presented, and how skilled he was in devising new and simple experiments to illustrate his statements. His work during these years was in the first instance mainly on light, and included his "Wave Theory of Light" contributed to the "Encyclopædia Britannica" in 1888.

A little later Lord Rayleigh took up the dynamical theory of gases and the question of the stability of the flow of fluids, then the densities of gases, and was led by this work to the discovery of argon. Later still he wrote on the constitution of the natural radiation from a heated body, on the sensitiveness of the ear, and on electric oscillations, in addition to taking up again a great number of questions on which he had previously written, in order to complete the solution of some problem hitherto only partially solved, or to fill up gaps in our knowledge.

It is impossible to look through the five volumes of Lord Rayleigh's collected papers, which have already been issued, without being struck with the vastness of the field over which his labours extended, his thorough acquaintance with the work of others, and the facility with which he could bring together the loose threads of a series of investigations and weave them into the consistent fabric recognisable as part of Nature's handiwork by "all them that have pleasure therein." The tale of his scientific work cannot be completed from his published papers. His services on scientific committees have been innumerable and invaluable, and there are very few of the younger men who came in contact with him who do not owe him a debt of gratitude for help and encouragement in the face of difficulties which seemed at the time insuperable. C. H. L.

PROF. ADRIAN J. BROWN, F.R.S.

THE sudden tragic close of the life of Prof. Adrian Brown on July 2, following the decease, only three days previously, of his wife, is a grievous shock to his many friends, and a great loss to chemistry, on the biological side in particular, as well as to the brewing industry. We can ill afford to lose men of his quality; always rare, present-day conditions do not favour their production.

A younger brother of Dr. Horace Brown, his early life was passed in Burton-on-Trent. He received his first lessons in chemistry from his brother, and was technically trained under Frankland at the Royal College of Science, which he entered soon after the school was established at South Kensington by the removal there, from Oxford Street, of the Royal College of Chemistry together with most of the staff of the Royal School of Mines from Jermyn Street.

On leaving college he became private assistant to Dr. Russell at St. Bartholomew's Hospital. In 1874 he was appointed chemist to Messrs. Salt and Co., brewers, of Burton-on-Trent. In 1899 he accepted the charge of a new department of the University of Birmingham devoted to the fermentation industries—the first of its kind. He filled this chair with conspicuous success, and was still in office at the time of his death in his sixty-seventh year.

In the 'seventies Burton-on-Trent was a remarkable centre of scientific activity, and full of inspiration for a young worker. Peter Griess was steadily laying the foundations of the azo-colour dyestuff industry, though nominally a brewing chemist (at Allsopp's); Cornelius O'Sullivan, who had accompanied Hofmann to Berlin, had returned to England to act as chemical adviser to Bass and Co., and was engaged on his pioneer investigation of the hydrolytic cleavage products of starch; and Horace Brown, at the brewery of Worthington and Co., was giving substance to the ideas communicated in Pasteur's "Etudes sur la Bière." These three men were leaders in an eminently alert society.

Plunged into such an atmosphere, and influenced by heredity, Adrian Brown could not but develop, but he did so gradually and on individual lines; the scientific copyist was not then in vogue. Turning his attention, naturally enough, to the problems of fermentation, he specially studied the oxidising organisms and the influence of oxygen on fermentation. His first paper, dealing with the action of *Bacterium aceti*, was published in 1886; in a later communication he described the results obtained with another organism, *B. xylinum*. In both cases he was able to show that the organism influenced oxidation in a selective manner. In this work, which was entirely original, he was far in advance of his time, and its importance was not recognised—indeed, is not yet recognised, notwithstanding Bertrand's later work on the subject.

Adrian Brown was the first to suggest that in cases of hydrolysis by enzymes the catalyst enters into combination with the hydrolyte.

In 1907 he began the publication of a series of remarkable observations made with a blue barley, showing that in the outer skin of the grain there is a differential septum impermeable by strong acids and alkalis and by most salts but penetrable by weak acids, ammonia and a large number of neutral substances, such as the monohydric alcohols, chloroform, etc. This work led to his election to the Royal Society in 1911.

Although a man of retiring habits and full of modesty, his personal charm of manner endeared him to all his friends. He exercised a wide influence on account of his experience and judgment, being much respected in his industrial circle. As a teacher he was remarkably successful, owing to his sympathetic attitude, his unlimited patience, and his faculty of realising the difficulties of his students. H. E. A.

THE TRANS-ATLANTIC FLIGHT OF THE R 34.

A DIRECT trans-Atlantic passage has been accomplished by the rigid airship R 34, which left East Fortune at 1.42 a.m. on July 2 and arrived at Long Island, New York, at 2 p.m. G.M.T. on July 6. The total distance flown was approximately 3100 nautical miles, giving an average speed of 33 land miles per hour. This low figure is accounted for by the adverse winds which were encountered, and also by the fact that the commander, Major Scott, was sacrificing speed for safety. Some difficulty was experienced at first on account of the low altitude necessitated by the great weight of fuel carried. Atmospheric disturbances were great at the mouth of the Clyde, near high hills. The weather was cloudy during the whole crossing, and only occasional glimpses of the sea were obtained to estimate the drift of the airship. Near Newfoundland the weather was very bad, and two electric storms were encountered, during which the wind varied rapidly from 10 to 50 miles an hour, and the airship was so tossed about that the crew gave her up for lost. It was after this trying period that Major Scott wirelessed for help, saying that his petrol was running short. Two destroyers were at once sent to render assistance, but Major Scott decided to attempt the completion of the journey under the airship's own power. His decision proved a wise one, and the great airship safely reached her mooring-ground in Long Island, but with only sufficient petrol remaining for a further ninety minutes' flight. The voyage was a very trying one for all concerned, and none of the crew had more than a few hours' sleep during the crossing.

The commander and crew are to be heartily congratulated on their great feat, and we can but admire the splendid pluck with which they carried on in the face of such great difficulties. It is obvious that in fair weather the R 34 would make the crossing with perfect ease, but it is also clear that we have a long way to go before the commercial use of trans-Atlantic airships is a reasonable proposition. The time taken when adverse winds are met is not very much less than that occupied by the fastest liners, while the useful weight which can be at present carried is extremely small. It is likely that larger airships will overcome the latter difficulty, since the gross lift of an airship varies as the cube of its length, while the power required for a given speed varies as the square. It follows that the larger ship has the greater percentage of its total lift available for useful merchandise. The great endurance of the airship is well brought out by the present flight, for it is almost certain that no existing aeroplane could have made the crossing under the same conditions. It is scarcely fair to attempt to form general conclusions as to the future of the airship from a pioneer flight made in circumstances of exceptional difficulty, and it would be wiser to wait until the feat has been repeated several times, when the possibilities of a commercial service and the directions in which improvement is to be sought should become apparent.

NOTES.

IN reply to a question in the House of Commons on July 8, Mr. Cecil Harmsworth stated that the appointment of Major C. E. Mendenhall, professor of physics in the University of Wisconsin, as Scientific Attaché to the United States Embassy has been notified to the Foreign Office by the United States Ambassador. No steps have as yet been taken by his Majesty's Government to appoint a Scientific Attaché to Washington. We believe the appointment of Prof. Mendenhall was a war measure, and that it has yet to be decided whether the post will be made permanent now that peace has been restored. It would be a progressive act on the part of our own Government to appoint Scientific Attachés to our chief Embassies.

MR. J. W. SIMPSON, corresponding member of the Institute of France, has been elected president of the Royal Institute of British Architects in succession to Mr. H. T. Hare.

THE Animals (Anæsthetics) Bill, which would make it an offence to perform certain operations on horses, dogs, cats, and bovines without the use of anæsthetics, was read a second time in the House of Lords on July 7, and was referred to a Select Committee.

MR. E. S. GOODRICH, Aldrichian demonstrator of comparative anatomy in the University of Oxford, has been elected membre-correspondant of the Société de Biologie of Paris, and also associé of the Académie Royale des Sciences, des Lettres et des Beaux-Arts de Belgique.

Two John Foulerton studentships for original research of medicine, the improvement of the treatment of disease, and the relief of human suffering will shortly be awarded by the Royal Society. The studentships are each of the annual value of 400*l.* and tenable for three years, with the possible extension to not more than six years. They are open to men or women. Further particulars and forms of application may be obtained from the Assistant Secretary of the Royal Society, Burlington House, W.1.

THE John Fritz medal of the four national societies of civil, mining, mechanical, and electrical engineering has been awarded, says *Science*, to Major-Gen. George W. Goethals for his achievement in the building of the Panama Canal. The presentation was made on May 22 by Ambrose Swasey, past president of the American Society of Mechanical Engineers. Among those to whom the medal has been awarded in former years are:—Lord Kelvin, for his work in cable telegraphy; Alexander Graham Bell, for the invention of the telephone; George Westinghouse, for the invention of the air-brake; Thomas A. Edison, for the invention of the duplex and quadruplex telegraph and other devices; and Sir William H. White, for achievements in naval architecture.

HAVING held its meetings at Taunton during the period of the war, the Somersetshire Archæological and Natural History Society had hoped to hold its seventy-first annual meeting and excursions away from headquarters, but this has been found impossible owing to the difficulty of hotel accommodation. However, long excursions will be taken into Devon on this occasion, viz. to Hembury Fort, Cadhay House (1545–87), and Ottery St. Mary Church on July 30, and to Exeter on July 31. The annual meeting will be held at Taunton on July 29 under the presidency of Mr. Henry Balfour, curator of the Pitt Rivers Museum at Oxford, and past-president of the Royal Anthropological Institute. The subject of his presidential address will be "The Doctrines of General Pitt Rivers and their Influence." The outgoing president is Dr. F. J. Haverfield, who addressed the society last year on "The Character of the Roman Empire as Seen in West Somerset." The society now consists of between 900 and 1000 members, and owns a large library and the Somerset County Museum at Taunton Castle.

BY the death, at the age of seventy-two, of Sir William Macgregor, G.C.M.G., the Empire has lost a great Colonial Governor and science an ethnologist and geographer of note. The son of an Aberdeenshire farmer, he was educated for the medical profession, and, like Cecil Rhodes, in order to save his life accepted the appointment of Medical Officer at Seychelles, Mauritius, and Fiji. Sir William Macgregor's opportunity came in 1888, when he was posted to British New Guinea as Administrator. For eleven years he was occupied in reducing the pagan savage tribes to order, and while his annual reports gave a clear account of his novel experiences, ethnologists in Europe were not slow to recognise the value of the material he had collected. He quickly realised the importance of New Guinea as the place of contact between the Melanesian and Papuan cultures, and it was largely due to his stimulus that valuable work has been carried out in this region by English ethnologists—Haddon, Rivers, Seligmann, and Williamson. After Sir William Macgregor's period of service in New Guinea he held in succession the office of Lieutenant-Governor of Lagos, Newfoundland, and Queensland, retiring from the last position in 1914. He received the honorary degrees of LL.D. from the Universities of Edinburgh, Aberdeen, and Queensland, and of D.Sc. from Cambridge, and he was a fellow of several learned societies.

THE strong earthquake which occurred on June 29 in the Mugello Valley, near Florence, seems, from the few details which have reached us, to have originated at or near Vicchio, fifteen miles north-east of Florence. This village and eight others are said to have been destroyed. The shock was also severely felt at Florence, Bologna, Pistoia, Pisa, and Pontedera. The Mugello Valley is a well-marked seismic zone, though not very often in action. In 1542, 1597, and 1611 earthquakes causing considerable damage occurred in the neighbourhood of Scarperia, about seven miles north-west of Vicchio, and a fourth in 1762 near Sant' Agata, one mile farther to the north-west. In 1835 an earthquake just strong enough to fracture walls originated at or near Vicchio, and in 1843 and 1864 others of the same or slightly greater strength at Barberino and Firenzuola. There can be little doubt that the recent shock is the strongest of those which have occurred in the Mugello Valley during the last four hundred years With regard to the statement, however, referred to last week, that the earthquake is the strongest experienced in Italy since 1895, Dr. Charles Davison informs us that the authority quoted must have been referring to the Florentine district. "The last earthquake there of importance occurred in 1895. Since then there have been far greater earthquakes in Italy, such as the Messina earthquake of 1908 and the Avezzano earthquake of 1915."

IN the Publications of the University of California on American Archæology and Ethnology (vol. xiv., No. 3) Mr. Llewellyn L. Loud publishes a memoir on the ethnogeography and archæology of the Wiyot Territory, lying on the shores of Humboldt Bay and the lower courses of the Mad and Eel rivers. Excavations show that among this tribe earth-burial replaced cremation. Their relation to the more northern Indians is best illustrated by the implements known as "slave-killers," though it is still uncertain whether these were actually used to kill slaves. From the little that is known of the culture of the Oregon Indians, particularly those of the Columbia Valley, we are able to trace some cultural relationship between these two groups of tribes, and it may be expected that further investigations will reveal other resemblances of these people to the Wiyot.

MR. R. F. BARTON in his account of Ifugao law, in the University of California Publications on American Archæology and Ethnology (vol. xv., No. 1), gives a valuable account of savage law. The Ifugaos of the Philippine Islands are a tribe of barbarian head-hunters, but, at the same time, they have reached a high level of material culture. Their system of terrace cultivation is specially noteworthy. One example, of which a photograph is given, is 12 km. long without a break in its continuity, and some of the terrace-walls are 60 ft. high. There is, of course, no written law literature, but their traditional social rules are most elaborate. As Mr. Barton writes:—"This people, having no vestige of constitutional authority or government, and therefore living in literal anarchy, dwell in comparative peace and security of life and property. This is owing to the fact of their homogeneity, and to the fact that their law is based entirely on custom and taboo." He adds that, before the American Government was established, the loss of life from violence of all descriptions was not nearly so great as in civilised communities.

IN the April issue of the *Journal of Mental Science*, under the title of "Psychoses in the Expeditionary Forces," Capt. O. P. Napier Pearn describes the differences and similarities in the actual insanities (psychoses) found in military and civil practice respectively. Of such cases he has personally investigated 2000 at the Lord Derby War Hospital, Warrington, which up to April, 1919, had admitted 6000. All these had seen some form of service with an expeditionary force. He has collected and tabulated the facts relating to 200 cases which made a sufficiently good recovery to warrant their being returned to duty, as being those concerning whom it is easiest to obtain some form of after-history. Capt. Pearn's article is welcome as affording material with which to compare our much more extensive data of the military psychoneuroses, *i.e.* those functional mental and nervous disorders which do not constitute actual insanity. He points out how, while at the onset of a mental disorder in civil life the friends and relatives usually co-operate with the sick person in shielding him from medical advice, such a patient in the Army, owing to exigencies of discipline, is much more likely to receive attention from his medical officer at an early stage. The effect of this early care is that these cases respond to treatment in a very gratifying way. The author insists that the patient's mental re-adaptation must be aided by therapeutic conversations, giving him insight into his mental make-up in order that when he meets again with difficulties in the outside world he will be more able to surmount them. The article, while laying claim to no new discovery, lays additional emphasis upon the urgency of the early treatment of mental disorders.

IN a note recently received from Prof. J. Mascart a striking cloud phenomenon seen in north-east France on July 8, 1918, is described. At 7.25 p.m. (S.T.) a wide belt of thin cirro-cumulus cloud had formed over the sky, and in this belt was traced out in the course of a few seconds a looped curve consisting of a roughly circular loop with two arms extending from it. The shape somewhat resembled the figure 6, but with the end of the ring continued out to the left hand. The curve, of a width of about a semi-lunar diameter, was marked by a complete absence of cloud in the otherwise uniform cirro-cumulus sheet, clear blue sky being visible throughout its length. The circular ring, which was somewhat flattened, was of about 20° diameter, and at an elevation of about 60–70° above the western horizon. The phenomenon remained visible for twenty-five minutes until the cloud-sheet evaporated. During this period the cloud drifted slowly from south-west to north-east, and the looped curve appeared to maintain its position unchanged relative to the cloudlets. Prof. Mascart puts forward the interesting suggestion that the clear path through the cloud which formed the curve was caused by the passage of a small cyclone or whirl in the upper layers of the air, which by mixing caused the cloud-particles to evaporate. It thus left a track through the cloud similar to that which a tornado marks out for itself on the earth by its path of destruction. A drawback to this hypothesis is the great speed at which the curve was generated.

MONTHLY results of magnetical, meteorological, and seismological observations for several recent months, and the Annual Report for the year 1917, of the Royal Alfred Observatory, Mauritius, show the maintenance of considerable activity under the directorship of Mr. A. Walter. Information of the probable state of the weather over the surrounding area of the southern Indian Ocean to a distance of five hundred miles is supplied to shipping in the harbour daily between November and May, and during the cyclone season information, when necessary, is telegraphed to Madagascar, Réunion, and Rodrigues. From May to September cablegrams are sent weekly to the Director-General of Indian Observatories in connection with the monsoon predictions. Daily observations of rainfall are received from about 150 stations in different parts of the island. During 1917 the logs of seventy-six voyages trading in the neighbourhood were copied under the auspices of the Meteorological Society of Mauritius. This work, being carried on during the period of the war, may afford valuable information to the British Meteorological Office. The report states that "the glass ball of the old sunshine recorder having become discoloured, a new instrument was ordered"; its registers have since been used. This defect suggests extreme caution in using the sunshine values of recent years. The monthly results of observations give hourly values for most of the elements, and these show great precision. In September, 1918, there is no single day without the double occurrence of maximum and minimum atmospheric pressures, whilst other data, such as the velocity of the wind, exhibit equally regular periods.

A NEW uniaxial hydrous magnesium aluminium silicate, styled colerainite, is described by Messrs. Poitevin and Graham in a paper on "The Mineralogy of Black Lake Area, Quebec" (Canada Geol. Surv., Museum Bulletin No. 27, 1918). Analyses are given of the fine crystals of vesuvianite from the Montreal chrome pit and neighbouring localities. The variations in their habit seem connected with their colour, which ranges from colourless through yellow and emerald-green to lilac. The minerals of the district, including chromite and chrysotile, are constituents of the great belt of serpentine that extends discontinuously from Vermont across the province of Quebec. We wish it were not too late to protest against the American use of the verb "intrude" in an active sense without a succeeding preposition. We thus read in a few lines: "These igneous rocks are found intruding sediments"; "Devonian strata are not intruded"; and "the igneous rocks were probably intruded in pre-Devonian time." The second and third of these passages cannot both be correct, and the third seems the only one that should be accepted by geologists who write in English.

STATISTICS of the mineral production of India for the year 1917 have been published in the last volume to hand of the Records of the Geological Survey of India, vol. xlix., part ii. These show that the Indian mineral industry is so far in a satisfactory condition in that the value of the products has risen to 13,351,364*l*., an increase of about 12½ per cent. on the value in 1916. In some cases this increase in value is due to a rise in the price of the commodity, which has been sufficient to compensate for an occasional falling off in the output. Nearly one-half of the total increase is due to coal, which contributes nearly one-third of the total value of the output, and in this instance it is satisfactory to note that the production has gone up by nearly a million tons to 18,212,918 tons. There was again a decrease in the output of gold by about 24,000 oz., the total yield being 574,293 oz., the decrease being almost wholly in the Kolar goldfield in Mysore. The production of manganese ore, too, has fallen from 645,204 tons in 1916 to 590,813 tons in 1917. Similarly there has been a falling off in the production of petroleum, namely, from 297,189,787 gallons to 282,759,523 gallons. On the other hand, it is interesting to note that the output of monazite in Travancore has increased from 1292·5 tons in 1916 to 1940·3 tons in 1917. The Bawdwin silver-lead mines in Burma have also increased their output, the lead produced having risen from 13,790 tons to 16,962 tons, and the silver from 759,012 oz. to 1,580,557 oz. There was a very trifling increase in the production of iron ore, and both the Tata Iron and Steel Co. and the Bengal Iron and Steel Co. were actively engaged throughout the year. Upon the whole, having regard to the difficulties under which the mineral industry laboured, the outlook for this industry in India appears to be very promising.

THE publication in March, 1917, of the regulation for preventing the misuse of the title of "engineer" in Austria has aroused great interest in Germany, where for many years abortive efforts have been made to achieve the same results. In Austria the title is now reserved for those who have studied at a technical college and passed both State examinations or taken the doctorate. The affiliation of the technical colleges to the universities was regulated by the law of April 13, 1901, giving such schools the right to confer the degree of doctor. The Austrian Society of Engineers and Architects has agitated for this protection for twenty-seven years (*Ztsch. des Vereins deutscher Ingenieure,* October 23, 1918), but the war has brought matters to a satisfactory head. In Germany it is thought a way out could be found by conferring the title "Dipl. Ing." ("engineer holding a diploma") or Engineer by Examination. The writer in the journal quoted, however, does not hold this view, and considers that no person unless properly qualified should be permitted to use the title "engineer."

A REPORT about to be issued by the U.S. Department of Commerce shows the great development of the electric light and power industry of the U.S.A. in the periods 1907–12 and 1912–17. The output of electric energy by the lighting and power stations increased at a considerably greater rate, and their expenses at a slightly greater rate, than their income. The total number of establishments in 1917 was 6541, 4224 being private and 2317 municipal undertakings. According to U.S. Commerce Report No. 84 (1919) (from which this note is taken), the total primary power in 1917 amounted to nearly 13,000,000 h.p.—an increase of 70·8 per cent. as compared with 1912. Of this power about two-thirds was derived from steam and about one-third from water, the slight surplus being obtained from internal-combustion engines. The total dynamo capacity in 1917 was, roughly, 9,000,000 kw., 74·3 per cent. more than in 1912; while the output of energy aggregated 25,500,000 kw.-hours, an increase of 119·9 per cent. for the period 1907–12. It is stated, incidentally, that incandescent electric lamps are rapidly exceeding arc lamps for street lighting.

IN a paper published in the June issue of the Journal of the Franklin Institute Gen. Squier describes experiments made on the use of trees as antennæ in radio-telegraphy and radio-telephony. He discovered in 1904 that certain trees, especially eucalyptus trees, could be usefully employed as antennæ. Owing to the dryness of the season and the nature of the soil at his camp in California, the regular Army "buzzer" telegraph and telephone sets were inoperative. When, however, they were connected to a nail driven into the trunk or roots of a tree they worked satisfactorily. During the war experiments were made on the efficiency of growing trees as antennæ. With modern sensitive amplifiers it was discovered that it was possible to receive signals from the principal European stations by simply laying a small wire netting on the ground beneath a tree and connecting it by an insulated wire to a nail driven in near the top of the tree. Instead of the wire netting, a few insulated wires buried a few inches in the ground were found to answer perfectly. Interesting tables are given showing the resistance and capacity of the conductor for various heights of the nail, and also by indirect methods—the open-circuit voltage—induced in the conductor.

THE Proceedings of the Physical Society for June 15 contains as an appendix, which has been issued separately, a report of the discussion on metrology in the industries which took place at the meeting of the society at the end of March. The discussion was opened by Sir Richard Glazebrook, and many manufacturers and others who had been concerned in the use of gauges in testing the accuracy of munition work turned out during the war took part in it. One of the most important facts brought out in the discussion was that many works which, by the use of gauges, were enabled to turn out work of a much higher order of accuracy than they had ever thought possible were now reverting to the old rule-of-thumb methods. Since quantity production and interchangeability are likely to prove essential features of the work of the future, it was suggested that this reversion should be so far as possible prevented by the issue of gauges in which the difference of size of the "go" and "not go" was considerably greater than in those used in first-class work. By this means the valuable principle of working to gauge could be retained even for the rougher work, and any future increase of accuracy which might be necessary would involve nothing more than a change of the gauges in use.

THE interesting new method of X-ray analysis initiated by Debye and Scherrer has been employed by A. J. Byl and N. H. Kolkmeyer to investigate the structure of ordinary white tin and the second variety of this metal known as grey tin, and an account of their work is published in the Proceedings of the Academy of Sciences of Amsterdam (vol. xxi., 1918). The method is eminently suitable for metals not available as single crystals, and for micro-crystalline substances in general. An X-ray tube with copper anticathode was used, the rays leaving the tube by an aluminium window. They passed thence through a narrow aperture in a thick leaden screen into a cylindrical camera. The tin lay in the axis of the cylinder in the form of a narrow bar, in one case of white hammered tin, and in the other of compressed grey tin. A photographic film, on which the interference lines were found after development to have been produced, was stretched against the wall of the camera. The interference lines resulting with grey tin showed at once that this variety of tin is also crystalline, and that the crystals belong to the cubic system. There appear to be eight atoms of tin to an elementary cube, which corresponds with the same structure as that of the diamond, and also with that of silicon. The tin in this form is obviously tetravalent. Ordinary white tin, according to Miller's measurements with electrolytic crystals, is tetragonal, and this fact is confirmed by the interference lines found in the experiments with the bar of this variety of tin. There appear to be three atoms to the elementary cell of the space-lattice, an atom lying at each corner of the tetragonal cell and one in the centre of each of the four prism faces of the cell, but none in the centres of the two basal-plane faces. This structure corresponds with atoms exhibiting prominently two valencies only. It would thus appear that grey tin possesses a structure corresponding with the exercise of the full tetradic valency of tin in the stannic salts, and ordinary white tin a structure corresponding with the exercise of its dyadic valency in the stannous salts.

THE first number of a new chemical journal, the *Chemical Age*, was issued on Saturday, June 21. The journal is to appear weekly, and to be devoted to industrial and engineering chemistry. It is now nearly five years since the *Chemical World*, a journal with corresponding intentions in regard to chemistry and chemical engineering, ceased to exist after the production of three volumes. Many people regretted its demise, for it was full of interesting matter and well got up, but the cause of its early failure was probably the fact that there was only a monthly issue, and something was wanted to keep pace with the current of events, rapid even before the war. This is more than ever true at the present time, when it may be said that the British manufacturer and the British public are at last waking up to the necessity of associating science with industry. The new journal has a larger page than the *Chemical World* or any of the other technical chemical journals, and is brought out at the moderate price of 21*s*. per annum, or 6*d*. a week. The first issue contains a number of interesting expressions of opinion from public men, including Mr. H. A. L. Fisher, Lord Sydenham, and well-known experts, including Sir Edward Thorpe, Col. Brotherton, Mr. James Swinburne, and others, in regard to the future of British chemical industry. On this subject there can be little difference of opinion, if only the same energy and skill already displayed continue to be employed and foreign competitors are excluded, at least for a time. The issues of the *Chemical Age* which have appeared so far contain matter of importance to every practical man connected with chemical industry, and we wish the new venture full success.

SOME analyses and tests of rigidly connected reinforced concrete frames are given in the University of Illinois Bulletin (vol. xvi., No. 8). The author, Mr. Mikishi Abe, derives formulæ for a number of such frames by the method of least work. Test frames were then designed according to the formulæ, and the experimental results were compared with those obtained by calculation. It was found that the elastic action of the frame and the manner of stress distribution agree fairly well with the analyses; that the locations of the points of inflection agree closely with the calculated positions; and that in carefully designed frames there need be no anxiety as to the rigidity of the joints, since effective continuity of members was found in the tests. There is a number of other deductions from the results which will be of service in design, and it would appear that the formulæ derived by analysis may be applied to a variety of forms of frames and are of wide applicability. Altogether, this bulletin constitutes a valuable contribution to our knowledge of reinforced concrete frames.

Messrs. Baillière, Tindall, and Cox are adding to their Industrial Chemistry Series "Animal Proteids," H. G. Bennett; "The Carbohydrates," Dr. S. Rideal; and "The Industrial Gases," Dr. H. C. Greenwood. The *Cambridge University Press* will shortly publish "An Enquiry concerning the Principles of Natural Knowledge," Prof. A. N. Whitehead, which will be divided into four parts, dealing respectively with the Traditions of Science, the Data of Science, the Method of Extensive Abstraction, and the Theory of Objects. *Messrs. G. G. Harrap and Co.* are publishing immediately "Physical Chemistry," Prof. A. T. Lincoln, and "An Introduction to Chemical German," E. V. Greenfield, with an introduction, notes, word-lists, and a vocabulary of German chemical terms. *Messrs. Longmans and Co.* have in the press "Elements of Vector Algebra," Dr. L. Silberstein. *Sir Isaac Pitman and Sons, Ltd.*, have just begun the publication of "Pitman's Technical Bookshelf." It is a record of their forthcoming and recent publications in science and technology, and contains also brief abstracts of articles from the technical Press. We learn from it that the following books may be expected shortly:—"Gas and Oil Operation," J. Okill; "Storage-Battery Practice," R. Rankin; "A Preparatory Course to Machine Drawing," P. W. Scott; a new edition, the fourth, of "Whittaker's Electrical Engineer's Pocket-Book," edited by R. E. Neale and completely re-written; and a new and enlarged edition of "Poole's Practical Telephone Book." *Messrs. J. Wheldon and Co.* have nearly ready "A Synoptical List of the Accipitres or Diurnal Birds of Prey," part i. (Sarcorhamphus to Accipiter), H. Kirke Swann. The edition is limited to 200 copies, only 100 of which will be offered for sale. *Messrs. Witherby and Co.* have in the press part i. of "A Geographical Bibliography of British Ornithology" (arranged under counties) from the earliest times to the end of 1918, W. H. Mullens, H. Kirke Swann, and the Rev. F. C. R. Jourdain. The work will be completed in six parts.

THE catalogues of Messrs. J. Wheldon and Co., 38 Great Queen Street, W.C.2, are always worthy of perusal. The latest one (new series, No. 87) is especially so, being a very complete and classified list of nearly three thousand books in zoological science arranged under the headings of Protozoa and Rotifera; Annelida; Hydrozoa, Polyzoa, Spongia; Echinodermata; Crustacea; Insecta; Mollusca; Marine Biology; Parasitology, etc.; Pisces (including Fisheries); Reptilia and Batrachia; Aves; Mammalia (faunas); Cetacea and Pinnipedia; Domestic Animals; Primates (and Man); General Zoology; Natural History; Biology, Anatomy, etc.; and Evolution, Heredity, Hybridity. Many very scarce works are included. The catalogue is certainly one to be consulted.

OUR ASTRONOMICAL COLUMN.

THE ECLIPSE AND WIRELESS TELEGRAPHY.—It will be remembered that a programme of observation was arranged to detect possible effects of the eclipse of May 29 on the transmission of Hertzian signals, and an interesting experience of this nature is reported by the French military radio-telegraphic authorities. There is at the observatory at Meudon a wireless reception apparatus, which on the day of the eclipse was arranged to receive the special signals sent from the Island of Ascension. It has been found that wireless messages from that place can be heard by night, though not by day, but during totality, when the shadow projected by the moon passed between Ascension and Meudon, the signals from Ascension were heard strongly. They then decreased in intensity, and ceased completely when the eclipse ended.

THE PARALLAX OF THE PLEIADES.—Prof. Kapteyn has proposed (Contributions Mount Wilson Observatory, No. 82) an indirect method of finding the mean parallax of the stars of a cluster by counting the number of stars of different magnitude it contains. The method requires a knowledge of the law of distribution of stars of different luminosity or absolute magnitude in the cluster, but if this is known, since apparent magnitude is a function of luminosity and parallax, it is possible to evaluate the latter from the data by formula. Dr. W. J. A. Schouten, of Aalten, Holland, is applying this principle to find the distance of star clusters, and gave thirteen of his results in the *Observatory* for March, the parallax of Præsepe being 0·024″, and the largest of the remainder 0·004″. He continues this in the June issue by giving details of his research on the Pleiades, and incidentally gives a valuable list of existing catalogues of the group. From the counts of stars of different magnitudes in five of these, in combination with a luminosity curve formed by Prof. Kapteyn, he deduces five values of the parallax which are in close accordance, and give a mean value 0·036″, with a probable error ±0·010″. Former determinations by Prof. Kapteyn and Prof. Plummer by other indirect methods gave 0·018″ and 0·024″ respectively. Dr. Schouten is encouraged to think that the comparative accordance of the results is some confirmation of his method.

PAINTING THE CORONA.—On the occasion of the total solar eclipse of June 8 last year (1918), which was observed with some success from stations in the United States, an unusual effort was made to obtain a picture of the phenomenon in its true colours. Mr. E. D. Adams, of New York, a benefactor to science, who joined the U.S. Naval Observatory eclipse party, took the responsibility for this, and, as colour photography was out of the question, enlisted the services of Mr. Howard Russell Butler, a portrait painter of repute, who has developed a short-hand method of noting both form and colour. Having prepared a drawing card with circles, radii, and angles marked, and having made himself mentally familiar with the kind of picture that might be seen, Mr. Butler utilised the 112 seconds of totality at his disposal by making a rapid sketch of the corona and prominences as he saw them, and wrote numbers on points and regions to indicate their colour according to his numerical colour-scale. The artist's first drawing was afterwards amended as to contours of luminosity by comparison with photographs, and then completed. The painting, which shows not only the prominences and corona, but also the sky around, was exhibited at the American Museum of Natural History, and a copy forms the frontispiece to *Natural History*, the journal of the museum, for March last.

THE BRITISH SCIENTIFIC PRODUCTS EXHIBITION.

THE second British Scientific Products Exhibition, promoted by the British Science Guild was opened at the Central Hall, Westminster, on Thursday, July 3, and it will remain accessible to the public until August 5. It will be remembered that the first exhibition was held in King's College last August, but owing to the arrangements of the college, due to demobilisation, it was found impossible to hold the present exhibition there. Last year's exhibition was afterwards transferred to Manchester, and it proved eminently successful in carrying into the provinces a knowledge of the recent achievements of British science and industry.

This year's exhibition was declared opened by the Marquess of Crewe in the presence of a representative company of scientific and technical workers. In his opening address Lord Sydenham, who occupied the chair, referred at some length to the important part played by British science and industry in the victory which has so recently crowned the Allied efforts. We proved ourselves superior to the enemy in every technical art, and but for the splendid co-operation of the leaders of science and industry our Army would have fought in vain.

In declaring the exhibition opened the Marquess of Crewe emphasised the difference between the present exhibition and the one held at King's College last year. The latter took place at a time when the result of the war was still doubtful, although the tide of battle was flowing strongly in our favour. Necessarily, therefore, it gave precedence to industries engaged primarily in the service of war. The present exhibition, on the other hand, is meant to show the triumphs of British industry in the arts of peace, and to bring home to the general public the importance of the relationship between science and industry, and also between education and research.

In this connection Lord Crewe dwelt on the desirability of introducing definite industrial courses for university students in technology, such courses to be taken in vacations at suitable works connected with the particular study the student is undertaking. Such an arrangement has worked with great success in the United States. The institution of industrial fellowships for post-graduate students attached to one or other of the universities would also have an important influence in keeping industries in touch with modern scientific developments, and, in addition, provide the country with highly trained technologists. The Department of Scientific and Industrial Research is endeavouring to do something on these lines by urging the establishment of industrial manufacturing associations which will carry on research in some particular technical branch.

The exhibits themselves are almost bewildering in their comprehensiveness. Practically every phase of British industry is represented, the various exhibits being divided into the following eleven sections:—Mechanical Science, Physics, Textiles, Electrical Appliances, Medicine and Surgery, Paper and Illustration, Agriculture, Chemistry, Aircraft, Fuels, and Metallurgy. Naturally, it is impossible to do more than touch superficially on the different groups.

In the Mechanical Science section G. Cussons, Ltd., of Manchester, are exhibiting various types of projection apparatus for testing form, profile, and screw-thread gauges. These instruments were devised at the National Physical Laboratory, and they have played an important part in the accurate and rapid testing of gauges which is so essential in the quantity production of machined parts. The Foster Instrument Co., of Letchworth, shows some interesting testing machines, including a modification of Dr. Stanton's impact testing apparatus, and also a notched-bar machine which yields a graphic record giving the history of the breaking of the specimen. A model of the first vessel to be fitted with Parsons marine turbines is shown by the Parsons Marine Turbine Co., and also a model exhibiting the interior of an engine-room of a two-shaft arrangement of Parsons geared turbine machinery.

In the Physics section Messrs. Hilger show some beautifully designed apparatus, including spectroscopes, polarimeters, and interferometers. The Meteorological Office has an exhibit of some excellent photographs and diagrams, and, in addition, some recently designed instruments for the determination of meteorological data. There are also some noteworthy exhibits of optical glass, and the items in the photographic section deserve more than cursory examination.

The latest thing in range-finders is shown by Messrs. Barr and Stroud, of Glasgow. The 30-ft. instrument is a triumph of both mechanical and optical skill. In something less than three seconds a range of ten thousand yards, with an error of less than twenty-one yards, can be signalled to the gun. For the direct reading of the range in these instruments some very fine gears have been designed. The anti-aircraft range-finder, where height, distance, and angle have to be determined rapidly, is a marvel of ingenuity and workmanship. The submarine periscopes, the watertight-door electric indicators, and the optical glass exhibit of this firm also call for special attention.

The Electrical section embraces the whole range from electric cooking to wireless telephony. Messrs. Marconi show a portable direction-finder and a small wireless telephony set; Messrs. Vickers show their magnetos, which have played such an important part in our aerial supremacy; and Everett, Edgcumbe, and Co. display a very fine selection of electrical measuring and controlling apparatus.

The Chemistry section bears eloquent testimony to the fact that in this branch of industry we have little now to learn from Germany either on the scientific or industrial side. We can produce our own laboratory glassware, our own filter-papers, our own analytical reagents, our own indicators, and our own drugs. Levinstein's, Ltd., again show the remarkable progress we have made in the dye industry, and quite a number of firms prove what can be done in the production of organic and inorganic compounds. The exhibit of the South Metropolitan Gas Co. emphasises the importance of coal-tar in the chemical industry.

The A.I.D. exhibits a representative collection of metallic and non-metallic materials employed in aircraft construction, together with a range of aeronautical instruments and equipment, models, and testing apparatus. The most interesting feature, perhaps, is that showing the most recent developments of the all-metal aeroplane. The instrument section is also of great importance, and, perhaps more than any other branch, shows the necessity for the trained physicist in industry.

Examples of recent developments in both ferrous and non-ferrous products are to be found in the section devoted to Metallurgy. Some interesting furnaces for heat-treatment purposes are also shown. In the refractory material section the Morgan Crucible Co. shows what can be done in the manufacture of the latest types of crucibles. Messrs. Hadfield exhibit a model of the largest armour-piercing shell in the world. This is of 18-in. calibre, and weighs about 1½ tons. The same firm shows a 17-in. hardened steel roll for the cold rolling of metals. This important key industry has now been entirely captured from Germany.

Displays of kinematograph films of scientific and technical interest are being shown at the exhibition from 3.30 to 5.30 p.m. on the following dates:—July 15, 17, 22, 24, 26, 29, and 31. The films illustrate (1) aircraft construction and utilisation, (2) the making of a big gun, (3) the water powers of Canada and their industrial utilisation, (4) wireless telegraphy and telephony, and (5) magneto construction. On Monday last a lecture on Chemistry in Reconstruction was given by Sir William Tilden, and yesterday Prof. W. H. Bragg lectured on Sound under Water and its Applications. The following lectures will be delivered at 5.30 on the dates named:—July 11, Coal Conservation, Prof. H. E. Armstrong; July 14, Progress in Range-finders, Prof. Archibald Barr; July 18, Explosives, J. Young; July 21, Progress in Aviation during the War Period, L. Bairstow; July 23, How the Cotton Plant Feeds as well as Clothes Us, S. E. de Segundo; July 25 (6 p.m.), A Few Thoughts on the Development of London, Raymond Unwin; and July 28, Scientific Lighting and Industrial Efficiency, L. Gaster.

STRONG ELECTROLYTES AND IONISATION.

IT is well known that the behaviour of strong electrolytes is very difficult to reconcile with the usually accepted theory of ionisation, in that the change of the degree of ionisation with the concentration is completely at variance with the requirements of the law of mass action. The abnormality of this very important group of substances is discussed in a series of papers by J. C. Ghosh (Journ. Chem. Soc., 1918, vol. cxiii., pp. 449, 627, 707, 790), who contends that the fundamental idea underlying the Arrhenius theory is not applicable to strong electrolytes. In place of this theory the author puts forward the view that the strong electrolytes are completely ionised, and that there is no question of the existence of non-ionised molecules in the usually accepted sense. The relations between the ions are controlled by the electrical forces, the magnitude of which corresponds with a certain potential which is characteristic of a given solution of an electrolyte. This potential affords a measure of the work which is required to free the ions from the influence of their mutual forces. Kinetic considerations suggest that the ions become "free" when their velocity exceeds a certain critical value, the fraction of the ions in this condition at any moment being shown by the ratio of the conductivity of the electrolyte in the given solution to the conductivity at infinite dilution. Assuming that the marshalling of the ions in solution corresponds with the arrangement of the atoms in the crystallised electrolyte, the author derives an expression for the characteristic potential in terms of the ionic charge, the dielectric constant of the medium, and the dilution of the solution. By introducing the Clausius virial theorem, the connection between the proportion of free ions and the osmotic ratio is deduced, and this relation differs notably from the well-known equation based on the Arrhenius theory. Experimental data relative to the influence of concentration, temperature, and solvent on the conducting power of strong electrolytes are shown to be in accord with the author's hypothesis, which is developed in the last paper of the series so as to account for the abnormally high speeds of the hydrogen and hydroxyl ions, for which no satisfactory explanation has yet been given.

THE FISHERIES AND THE INTERNATIONAL COUNCIL.[1]

II.

WE now come to the consideration of the hydrographical, meteorological, and physical work of the International Council in relation to the fisheries problems put before it. Out of a total of seventy fascicules of the "Publications de Circonstance," no fewer than thirty-one belong to this section, and this in an inquiry specially devoted to the food-fishes. Besides, there is a great bulk of large quarto hydrographic and planktonic volumes which far exceeds anything else in the Council's publications. The special value of these to hydrographers does not concern the present criticism, but considerable dubiety surrounds the attempt to connect, for instance, oceanic currents with the eggs, larvæ, and young of the fishes, especially when, in their own words, such gives "some notion of how very complicated the question of the passive movements of the pelagic stages under the influence of the currents really is, and how it assumes a different form in each species." This view takes for granted that the larvæ and young are as passive as the eggs—a supposition dealt with long ago. Secondly, in other words, there are special currents which keep and carry the eggs and larvæ of the haddock annually to deep water, and others which bear with unfailing regularity the young cod shorewards; likewise others, with similar annual rhythm, sweep the larval and post-larval frog-fishes from their floating ribands of gelatinous mucus to deep water, along with such vagrant larvæ of the skulpin as have been hatched near the shore; still others which take the young plaice during the change of the eye to the beach and, with nice discrimination, leave the long rough dabs and a number of dabs in deep water in the neighbourhood of their birthplace.

It would be interesting to inquire for the special currents which distribute the young of the viviparous Norway haddock in the open water, or for those which pass by the young of the viviparous blenny in the rock-pools, or, by way of variety, for those motionless waters which leave the young herrings, like a carpet of threads, over square miles of the inshore waters, and for those special currents which invariably plant the young wolf-fishes, after their escape from the huge masses of large adhesive eggs, on rough ground. The hydrographers have, moreover, overlooked the "currents" which carry fishes and invertebrates hatched on the bottom to the surface of the water, and those, when they are older, which carry them down again. They have missed those discerning currents which, in the case of the ubiquitous pelagic eggs of the rocklings, convey some shorewards and send others to the deeper water. Moreover, they have forgotten the variable action of the winds in modifying the currents.

Briefly, each species would thus appear to have a current to itself and adapted to its special needs—a supposition which cannot be accepted. The case of the North Sea Bank is given, in illustration, as a spawning area from which the small larvæ are distributed over the whole deep part of the Skagerak, the Norwegian channel and sea. It is stated that "typical tidal movements have been demonstrated in the North Sea, the resultant movement of which is often different in the different depths. This might possibly be sufficient to separate the eggs in one layer from those in the other. For the rest, this disposition is naturally very different in the different parts of the North Sea." Such uncertain groping for an anchorage of an important science in the fisheries is unworthy of it. Support is drawn by the Council from Johs. Schmidt's observations in Iceland, already mentioned, but these might readily be interpreted otherwise. An interesting local case, however, is that of the Atlantic current in the Baltic Sea, where it forms an intermediate one between the top and the bottom, and, it is said, the eggs of plaice have alone been found in it as far as Bornholme. The adults pass higher up, but it is suggested that they come back to spawn there. These observations would require confirmation, and, in any case, cannot hold for the plaice of the North Sea

[1] From a lecture given in Aberdeen on March 4 by Prof. McIntosh, F.R.S. Continued from p. 358.

generally, though it is stated that a similar condition exists in the southern North Sea.

The notions about fishes tending to accumulate about "the meeting of the waters," the spreading of water of low salinity from the Baltic over the North Sea, and the entrance of a little of the Gulf Stream at either end may be interesting, but it is more or less fanciful to say: "The direct influence of this system of currents on the life of the fishes is immense, for by its means their floating eggs and young are dispersed or disseminated broadcast. In the south those of the plaice and sole are carried over to their nursery grounds on the flat Danish shore, and in like manner the eggs and fry of the cod are drifted from the western coasts round the north of Scotland, and in part out again to the sea of Norway." Unfortunately for this romance, the eggs and young of the spawning plaice of our eastern shores float, drift, and swim in myriads to the tidal margin there. The eggs and young of the spawning cod off the Isle of May follow a similar course, the young appearing in numbers amidst the tangle-forests inshore in June, whilst the eggs and young of the haddock seek the deeper water offshore, the young only appearing inshore when 5–6 in. in length. Again, the eggs and young of the sole find another home than that on the Danish shore, and for hundreds of years have swarmed, and swarm now, in the estuary of the Thames and other parts of the southern coasts. All this, and much more, takes place irrespective of the endless text-figures of currents—circling as well as sinuous and straight—and also of endless columns of temperatures and salinities, the production of which has absorbed so large a share of the time and funds of the International Council.

The day has not yet come for so simple a solution, which, moreover, does not fit in with the herring either in its larval, post-larval, young, or adult condition. High hopes sprang up in some quarters from the so-called "classical" instance of the herring in the Skagerak and Kattegat, the abundance or scarcity of which, as well as of the fisheries generally of southern Sweden, was said to depend on the ebb and flow of a layer of cold salt water; but these comparatively narrow entrances differ much from the North Sea, just as the Baltic herring differs from that of the open ocean. These high hopes have not been realised after the sixteen years' labours of the international workers in the North Sea. Currents, temperatures, alkalinities, and salinities cannot alter the original instincts of a food-fish.

The western waters of Scotland, again, differ from those of the eastern shores, and the fish-fauna is supposed to differ considerably in the two areas; yet herrings frequent both, as likewise does the green cod, whilst the common wrasse represents in the east the swarms of the same group in the western lochs. Both are frequented by the salmon, by the conger, and by the dog-fishes, and the littoral belts have many fishes in common.

The sum-total of the labours and heavy expenditure of the hydrographical department up to date, and in relation to the task entrusted to the International Council, is very much as it was in 1907, but it is only right to state that the several reports from which the Council drew its conclusions all display the energy and resource of the observers in carrying out their tasks in the North Sea. The criticism applies to the summary of the Committee.

From a survey of the whole work of the International Fisheries investigations, and with the most generous interpretation of the labours of the various workers, who have in many cases advanced our general knowledge of the life-histories and distribution of the food-fishes, it cannot be said that they have settled the main questions (already stated) they were appointed to solve, viz.: "Whether the quantity and consumption of fish taken from the North Sea and neighbourhood are in proper proportion to the production occurring under the prevailing natural conditions, and whether any disproportion between production and consumption arises from a local over-fishing or from an injudicious employment of the fishing apparatus at present in use." They are as uncertain now, notwithstanding all the official explanations, as they were at the beginning; whilst during those sixteen years the views of some have been kaleidoscopic, and ever calling for longer time and for further investigations. It is true that fewer large plaice are caught on an oft-trawled area, as has frequently been pointed out, but the swarms of young which the same records demonstrate are a sufficient guarantee for the future. After these labours to combat the views expressed in 1898, the Council concludes with but a single recommendation, viz. protection of the plaice, as detailed on p. 7. It observes: "(1) It is very probable that the density of the plaice shoals has decreased in a notable manner, and the absolute size of the plaice-stock thus diminished; (2) that the diminution of the plaice-stock has not affected all size-classes in an equal degree, but especially the larger and older plaice. This appears in the catches and landings from a relative reduction in the number and weight of the large, and increase in the small, plaice, as well as from a decrease in the average size of the plaice."

In other words, all that can be said is that plaice are not less numerous, but, according to the methods of the Council, they are smaller—a finding which leaves the plaice in safety. The larger plaice frequent the deeper water, where it is less easy to capture them, and that a sufficient number survive to keep up the stock of the smaller plaice the Council freely admits in every case by the mention of swarms of young, even on the oldest fishing areas. Besides, many years' longer experience of typical plaice grounds on open borders shows that the efforts of man—by net, hook, and trawl—fail to make any serious impression on the multitudes of the younger forms. Similar experience may be found in the older official records, and, further, years of decrease of the plaice-fishing have been followed by years of substantial increase; so that the steps for what was called "concerted international action" were arrested. The idea that the North Sea can be fished out is chimerical, for even if it were all gone over thrice or more frequently a year, such could not produce depletion or exhaustion of its fisheries—plaice included. Besides, 13 per cent. of its area cannot be trawled, and, with the northern and other increments, that is sufficient to maintain its resources.

For sixteen years the answer to the problems submitted to the International Council has been waited for, and yet it is as far distant as ever; nor does it appear that anything more definite will arise from these expensive experiences—which do not seem to be even salutary.

If the able international investigators had, indeed, searched the various areas in the North Sea themselves, or if the Council had completed an arrangement for the uniform collection of fishery statistics by all the countries bordering on the North Sea, a great advance would have been made. Further, it may be asked: What has the Council done "to discover the limit to which fishing grounds can be depleted without undergoing serious injury"; in proving that in a given area the larger forms are permanently diminished by constant trawling; in discovering whether in such areas the fishes become more wary; in showing that the shoals are thus driven from a particular ground; in demonstrating the effects of sudden changes in the methods of capture; and in deciding as to the value of sea-fish hatcheries? The expenditure of more than 100,000*l*. by this country alone has not enabled the Council to grapple with the constantly recurring complaint about the decadence of the sea-fisheries, or to fulfil the promises which heralded its appointment; yet the expenditure continues, and, to judge by the character of the publications forthcoming, the fundamental facts required are still in abeyance, though, it is true, the impoverishment of the sea is now seldom mentioned, whilst the facts in relation to the soundness of the views in "The Resources of the Sea" have been augmented. That at least is a gain.

The foregoing views as to the safety of the sea-fishes of our country have long been held, and from a different point of view, by such distinguished men as Prof. Huxley, Lord Eversley, and Sir Spencer Walpole, besides others of more modern date. Lord Eversley's recent papers are a sufficient answer to those who wrongly asserted that Prof. Huxley, his old colleague, changed his opinions.

If but a fraction of the great expenditure had been devoted to marine laboratories, where personal contact of the workers with the sea and its fisheries would have laid a sure basis for original work in this and cognate departments of marine research, there can be little doubt that the country would have been better served. It seems a paradox that a Secretary for Scotland, the same who in 1898 refused an offer for the repetition on the same areas of the trawling experiments of 1884, should challenge and withdraw an annual sum of less than 100*l*. for the upkeep of a marine laboratory where much of the pioneer scientific fishery work in this country was done, and yet countenance this costly international enterprise which has ended in results so uncertain and so disappointing in many respects to the nation, and gave facilities to the Germans for familiarising their seamen with the coasts of the North Sea for other than fishers' work.

Finally, the day will soon come, if it has not already done so, when such crude notions as to the impoverishment of the sea-fisheries will utterly lapse, and, whilst safeguarding the yield of the sea by every reasonable measure, the authorities and the public will place implicit confidence in the resources of the ocean and the ways of Nature therein; and these conclusions apply, not only to the North Sea, but also, in the main, to all the great sea-fisheries of the world, including those of Canada, the Cape, Australia, India, New Zealand, the United States, France, Japan, Russia, Norway, Sweden, and, with modifications, to those of the countries bordering on the Mediterranean. The closure of large areas of the sea rests on no scientific basis, though it may be politic in the interests of certain classes of fishermen; and there can be no doubt that the public, by such closure, is deprived of a large and perennial supply of fishes of easy capture—for instance, from the Moray Frith. If a small bay like that of St. Andrews can defy the local and immigrant fishing-vessels of all kinds, and hold its own even on a narrow strip, what permanent effect can the mere scraping of about three-fourths of the North Sea (Moray Frith included), with its 140,000 square miles, a few times a year have on its fish-fauna, especially when it has a considerable area of untrawlable ground, not to allude to the belt within the three-mile limit, or to the vast increment of young fishes it receives from the north, and more sparingly from the south? The stability of "The Resources of the Sea" as regards food-fishes does not rest on a single fact, but on all the facts, and on an unbroken chain from the simplest plants and animals through all the various grades up to the food-fishes; and this stability remains unshaken after the efforts of the International Council and its investigators, some of whom still continue to pin their faith to the mechanical manipulation of statistics of the catches at various ports.

What was said in 1907[2] has additional force to-day, viz. it is indeed fortunate for this and other nations that the unbroken chain of circumstances combines to render the sea-fishes so capable of holding their own, not only in former geological periods, when, for instance, the gigantic fish-eating Ichthyosauria traversed the seas from pole to pole, but also to-day. For what alternatives are before us?

Artificial hatching, while admirable in fresh-water and anadromous fishes, has not been proved (and this is said with all deference to the efforts of the Americans, our own countrymen, and others) to be of actual service in marine fishes, the young of which are everywhere so numerous. Besides, the heavy expenditure would ill be borne by the taxpayers when the foreign fishermen share equally with their own.

Transplantation could readily be carried out, especially with flat-fishes, though under the same international disadvantages; yet Nature in the open waters needs little aid in this respect.

More might be said in favour of a size-limit, but that more has much of sentiment in it; for whilst the ordinary fisherman dare not sell his small fishes, and could not eat them, many—indeed, almost all those hooked, and a larger or smaller proportion in the trawl—would perish. But what would the Legislature make of the destructive shrimper, who cares neither to sell nor to eat the small fishes? Moreover, it is hollow legislation which imposes a penalty in the case of small flat-fishes, and is purblind to the destruction of small round-fishes.

To him who revives and nurses the barren fears and doubts of many centuries, and to the disciple of "The Impoverishment of the Sea," there is thus little comfort in the sound of alternatives.

On the other hand, the plenitude and the endurance of the sea-fishes are marvellous, yet true. Nature is even prodigal in their vast abundance and variety. Indeed, it is by no means certain whether the combined destruction caused by invertebrate marine animals, from the democratic jelly-fish (Pleurobrachia) to the predatory cuttle-fish; by the food-fishes themselves, many eating their smaller brethren or the young of their neighbours, even the herring swallowing dozens of the floating eggs of the white fishes with its food; by voracious fishes like sharks, dog-fishes, and skate; by the vast army of piscivorous birds; by the multitude of whales, single and social; and by the seals—I repeat, it is by no means certain whether this combined destruction does not equal, if not exceed, in numbers at least, that of man himself.

Let us then be chary of futile international or other expenditure in search of a phantom, but at once organise the scientific staff of each centre of the kingdom on a modern (*i.e.* apart from agriculture), effective, yet not costly footing, and, whilst vigilant in guarding the national trust and in checking any avoidable waste of fish-life, let every well-conducted method of capturing the sea-fishes be free from unnecessary restrictions. The unparalleled services of both liners and trawlers to the country during the late crisis merit no less.

[2] Lecture II., Royal Institution, p. 19.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

BIRMINGHAM.—The following degrees in science have been awarded:—*Doctor of Science:* J. E. Coates, C. K. Brain, Blanche Muriel Bristol, Nellie Carter, Alfred John Grove, Leslie Herbert Lampitt, and C. M. Walter. *Master of Science:* Daisy Louisa Ibbs, Helena Charlotte Chance, C. A. F. Hastilow, R. H. Humphry, A. M. Mehrez, Abd El Rahman El Sawy, and Mostapha El Sayed.

The following appointments to vacant chairs have been made:—Dr. John Robertson as professor of hygiene and public health, Dr. John Shaw Dunn as professor of pathology, and Mr. Leonard Gamgee as professor of surgery.

Prof. Haslam has been appointed lecturer in applied anatomy.

Prof. Peter Thompson has resigned his office as Dean of the faculty of medicine, and Prof. Haslam has been appointed to succeed him.

Mr. William Haywood has been appointed lecturer in town-planning.

Mr. B. T. Rose has been appointed demonstrator of anatomy, and Miss Hilda Walker lecturer in physiology.

CAMBRIDGE.—Mr. C. T. R. Wilson has been appointed reader in electrical meteorology.

LONDON.—The following have been appointed to lectureships in the subjects indicated, tenable at University College:—*Faculty of Science:* Mr. J. C. Flügel (psychology), Mr. E. J. Salisbury (botany), Dr. Paul Haas (plant chemistry), and Dr. Francis W. Goodbody (medical chemistry). *Faculties of Science and Engineering:* Mr. H. T. Davidge (applied mathematics). *Faculty of Engineering:* Mr. C. C. Hawkins (electrical design).

The Senate of the University has instructed the Principalship Committee to proceed to recommend one or more persons for appointment to the position of Principal Officer. In 1915 the University advertised the appointment and certain applications were received, but the Senate did not then proceed to fill up the vacancy. Applications already received, together with any other names which may be brought to the notice of the Senate, will be considered by the Principalship Committee.

APPLICATIONS are invited for a Lee's readership in chemistry (with special reference to the inorganic and physical sides of the subject) at Christ Church, Oxford. The stipend to begin with will be 450*l.* annually. Applications for the appointment must be received before September 10 by Mr. R. E. Baynes, Christ Church, Oxford.

APPLICATIONS for not more than three Ramsay memorial fellowships for chemical research will be considered by the trustees at the end of the present month. The value of each fellowship will be 250*l.* annually, with the possible addition of not more than 50*l.* for expenses. The fellowships will be tenable for two years normally, and may be extended to three years. Applications must be made to the organising secretary of the Ramsay Memorial Fund, University College, Gower Street, W.C.1, not later than July 14.

THE Merchant Venturers' Secondary School, which has been conducted for many years as a part of its technical college by the Society of Merchant Venturers, an ancient Bristol guild, will at the end of the present term be transferred to the Bristol Education Committee, and will become a municipal school. The Merchant Venturers conduct in their college the faculty of engineering of the University of Bristol, and the urgent need for additional space for this rapidly growing faculty has made it impossible for them to continue to house the secondary school.

THE special feature of the July issue of the "Readers' Guide," published by the Norwich Public Library (post free 2*d.*), is a classified and annotated list of books and articles on the important subject of coal and the nationalisation of coal-mines, which should be of much practical use at the present time. The list comprises a representative selection of the principal writings on the subject, and is divided under the following headings:—Bibliography; Natural History; Legislation; General and Economic, with a subdivision "Books for Juveniles"; Conservation; Statistics; Reports of Royal Commissions, etc.; Nationalisation; and Mining.

LONDON will now come into line with the newer universities in having a faculty of commerce, which it is proposed to open on October 1. The general plan for degrees in commerce was first put forward about a year ago, and the scheme which is about to be put into operation is the result of long deliberations between prominent City men and the University authorities. For the present, provision has been made for granting two degrees—the B.Com. and the M.Com. Certain subjects will be compulsory for the former, viz. economics, banking, currency, trade and transport, finance, geography, and a modern foreign language. Different classes of students will be expected to specialise in addition in subjects which have a particular interest for their calling. Bankers, for instance, would take world-history, with special reference to the nineteenth century; other students might take accounting, and so on. The B.Com. will necessitate three years' work, and one of the strong features of the course will be the attention paid to a modern language. The choice is undoubtedly ample, for, besides French and German, the list will include Polish, Czech, Rumanian, modern Greek, and the great Eastern languages. For the M.Com. two years' practical commercial experience will be required. The underlying idea here is to regard work in a merchant's office as equivalent to the practical work of the medical student in a hospital or of the engineering student in a workshop or factory.

SOCIETIES AND ACADEMIES.

PARIS.

Academy of Sciences, June 16.—M. Léon Guignard in the chair.—MM. A. **Lacroix** and **Tilho**: A geological sketch of Tibesti, Borkou, Erdi, and Ennedi. The sedimentary formations.—G. **Bigourdan**: Work of the Naval Observatory. Historical account of observations made between 1752 and 1796.—H. **Deslandres**: Remarks on the constitution of the atom and the properties of band spectra.—C. **Guichard**: Isothermal surfaces.—E. **Ariès**: The saturated vapour pressures and latent heats of evaporation of propyl acetate at various temperatures. From the equation of state developed in earlier communications, formulæ are deduced and applied to the calculation of the vapour pressures and latent heats of evaporation of propyl acetate; the figures are compared with the experimental results of S. Young with very satisfactory agreement.—M. E. Mathias was elected a correspondant in the section of general physics in succession to M. Georges Gouy, elected non-resident member.—E. **Kogbetliantz**: Trigonometrical series.—G. **Reboul**: The phenomena of luminescence accompanying the oxidation of potassium and sodium. This effect appears to be due to the formation and rupture of a skin of hydroxide; the presence of moisture is essential.—H. **Abraham** and E. **Bloch**: The maintenance of mechanical oscillations by means of lamps with three electrodes.—G. **Baume** and M. **Robert**: A glass manometer with elastic walls. The instrument described and figured consists of a thermometer with a bulb made with thin flat walls. This is surrounded with a glass envelope containing the gas the pressure of which is to be measured. The apparatus can be utilised as a null instrument by connecting one side to an ordinary mercury manometer, or can be used directly after calibration. A set of measurements of the pressures of nitrogen peroxide at different temperatures is given as an example of the application of the manometer.—A. **Joannis**: Some properties of the acid phosphates. An account of the action of liquid anhydrous ammonia on the mono- and di-alkali phosphates.—J. **Guyot** and L. J. **Simon**: The action of dimethyl sulphate on the sulphates of the alkalis and alkaline earths. A mixture of methyl sulphate and potassium sulphate in equi-molecular proportions when heated to 200° C. reacts quantitatively to form potassium pyrosulphate and methyl ether. The action of sodium or lithium sulphate is similar, but the reaction is not complete.—Ch. **Audebeau Bey**: The lowering of the north of the Egyptian delta since the Roman Empire.—S. **Stefanescu**: The structure of the plates of the molars of *Elephas indicus*, and the different origin of the two species of living elephants. A study of the molars leads to the conclusion that the origin of *Elephas indicus* is quite different from that of *Elephas africanus*.—A. **Baldit**: Certain cases of diminution of the wind velocity with altitude.—M. **Mascré**: New remarks on the *rôle* of the nourishing layer of pollen.—S. **Posternak**: Two crystallised salts of the phospho-organic reserve principle of green plants. The two salts, details of preparation and purification of which are given, have the compositions $C_6H_{12}O_{27}P_6Ca_2Na_8$ and $C_6H_{12}O_{27}P_6Na_{12}$.—J. **Amar**: The hæmatopneic coefficient.—P. **Woog**: The variable persistence of luminous impressions on different regions of the retina.—A. **Robin**: The soluble and insoluble nitrogen in the tissue of cancerous liver; new conception of the genesis of cancer.—H. **Bierry**: Proteid sugar.—H. **Coutière**: The limb of the Arthropods.—E. **Sollaud**: The embryonic development of the Palæmonidæ.—P. C. **de Baillon**: The existence in locusts and crickets of an organ serving for the rupture of the chorion at the moment of eclosion.—M. **Baudouin**: Mode of ossification of the great trochanter in man of the polished Stone period.

BOOKS RECEIVED.

Text-book on Practical Astronomy. By Prof. G. L. Hosmer. Second edition. Pp. ix+205. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 9*s*. 6*d*. net.

The Preparation of Substances important in Agriculture. By Prof. C. A. Peters. Third edition. Pp. vii+81. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 4*s*. net.

Australia: Problems and Prospects. By the Hon. Sir Charles G. Wade. Pp. 111. (Oxford: At the Clarendon Press.) 4*s*. net.

Vicious Circles in Disease. By Dr. J. B. Hurry. Third and enlarged edition. Pp. xx+377. (London: J. and A. Churchill.) 15*s*. net.

The Nile Projects. By Sir William Willcocks. Pp. xvi+184+plates 6. (London: E. and F. N. Spon, Ltd.)

DIARY OF SOCIETIES.

MONDAY, JULY 14.

FARADAY SOCIETY, at 8.—L. A. Wild: A Method of Measuring the Magnetic Hardness of Ferrous Metals and its Utility for carrying out Research Work on Thermal Treatment.—K. Honda and H. Takagi: A Theory of Invar.—W. E. Forsythe: The Disappearing Filament Type of Optical Pyrometer.—Dr. A. W. Porter: The Equation for the Chemical Equilibrium of Homogeneous Mixtures. I. Equilibrium at Constant Temperature.—F. H. Jefferey: The Electrolysis of Solutions of Sodium Nitrate using a Silver Anode.—I. Langmuir: The Mechanism of the Surface Phenomena of Flotation.—E. A. Ashcroft: Some Chemically Reactive Alloys.

TUESDAY, JULY 15.

SOCIETY OF CHEMICAL INDUSTRY (at the Mansion House), at 11 a.m.—Annual General Meeting. Address by the President, Prof. Henry Louis.—At 3.30 p.m.—Conference. Sir William J. Pope: Inter-Allied Chemical Federation.—Prof. C. Moureu: "Sir William Ramsay."

WEDNESDAY, JULY 16.

SOCIETY OF CHEMICAL INDUSTRY (at the Clothworkers Hall, Mincing Lane, E.C.), at 10.30 a.m.–1 p.m., and 3–5 p.m.—Conference on the Production and Consumption of Sugar within the British Empire. *Speakers*: Major Courthope, Sir Richard Garton, Sir Daniel Hall, W. Martineau, Dr. E. J. Russell, Sir George Sutherland, and Louis Souchen.—At the Salters' Hall, St. Swithin's Lane, E.C., at 10.30 a.m.–1 p.m., and 3–5 p.m.—Conference on Power Plant in Chemical Works. Capt. C. J. Goodwin: Waste Heat Boilers and Pulverised Fuel in Chemical Factories.—A. H. Lymn: Modern Gas Producer Practice for Power Purposes.—J. L. Hodgson: Differential Pressure Meters for Measuring Gas, Steam, and Air Flow.—Prof. W. A. Bone and P. St. G. Kirke: Recent Developments in Surface Combustion Boilers.—P. Parrish: A Modern Chemical Works Power Plant and the Production of Steam from Low Grade Fuel.—Prof. J. W. Hinchley: Notes on the Operation of a Chemical Works Power Plant.—H. Martin: Electrical Supply in a Chemical Works.

THURSDAY, JULY 17.

SOCIETY OF CHEMICAL INDUSTRY (at the Salters' Hall, St. Swithin's Lane, E.C.), at 10.30 a.m.–1 p.m., and 3–5 p.m.—Conference on Dye Stuffs, Synthetic Drugs, and Associated Products. Dr. Herbert Levinstein: Progress in the British Dyestuff Industry.—James Morton: Dyestuffs and British Textiles.—Prof. G. T. Morgan: Certain Colour-producing Intermediates.—E. V. Evans: The Manufacture of Intermediates.—F. H. Carr: The Manufacture of Synthetic Drugs.—Dr. W. R. Innes: Photographic Chemicals.—Dr. M. O. Forster: The Organised Preparation of Laboratory Chemicals.—At the Goldsmiths' Hall, Foster Lane, E.C., at 10.30 a.m.–1 p.m.—Conference on the Chrome Tanning Industry. Prof. D. McCandlish: The Development of the Chrome Tanning Industry in the United States of America.—M. C. Lamb: The Progress of the Chrome Tanning Industry in Great Britain.—Dr. Gordon Parker: The War Services of the Chrome Tanning Industry.—At 3–5 p.m.—Conference on Recent Developments in the Fermentation Industries. Sir Frederick Nathan: The Manufacture of Acetone.—Amos Gill: The Acetone Fermentation Process and its Technical Applications.—A. Chaston Chapman: The Employment of Micro-organisms in the Service of Chemical Industry—A Plea for a National Institute of Micro-biology.

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