THURSDAY, AUGUST 1, 1912.

MECHANICAL AND CHEMICAL ENGINEERING.

(1) *An Introduction to the Study of Fuel.* A text-book for those entering the Engineering, Chemical, and Technical Industries. By Dr. F. J. Brislee. (Outlines of Industrial Chemistry Series.) Pp. xxii + 269. (London: Constable and Co., Ltd., 1912.) Price 8*s.* 6*d.* net.

(2) *Diesel Engines for Land and Marine Work.* By A. P. Chalkley. With an introductory chapter by Dr. Rudolf Diesel. Pp. xi + 226. (London: Constable and Co., Ltd., 1912.) Price 8*s.* 6*d.* net.

(3) *Transactions of the American Institute of Chemical Engineers.* Volume iii, 1910. Pp. iv + 407. (New York: D. Van Nostrand Company, and Spon and Chamberlain; London: E. and F. N. Spon, Ltd., 1911.) Price 25*s.* net.

(4) *Reinforced Concrete Compression Member Diagram.* By Charles F. Marsh. (Diagram in case.) (London: Constable and Co., Ltd., n.d.) Price 3*s.* 6*d.* net.

(5) *Railway Signal Engineering* (*Mechanical*). By L. P. Lewis. (The Glasgow Text-books.) Pp. xviii + 358. (London: Constable and Co., Ltd., 1912.) Price 8*s.* net.

(1) THERE is scarcely any subject that repays scientific study better than that of the use (and abuse) of fuel, not only to the engineer and chemist, but to those who direct industries that consume fuel in one form or another. The profligate waste of our natural resources of fuel shows direct and melancholy evidence that the truths governing its utilisation are the property of a limited few, and that those who direct industries are only tardily learning that the trained chemist can teach many lessons of practical value. Such a volume as the one before us is to be welcomed, for though Dr. Brislee assumes technical knowledge on the part of the reader, it is no more than the elements of chemistry which those who control industries should possess or can command. Beginning with elementary chemical reactions, he shows how the equations of the chemist are not mere text-book conundrums, but the representation of actual changes taking place in every furnace, retort, and heat engine. He goes on to ascertain the weight of air necessary for the complete combustion of fuels of definite chemical composition, and chapter ii. makes this clear without unduly straining the reader's knowledge of elementary chemistry. The well-known methods of analysis are treated admirably, including the Orsat apparatus for determining the CO, CO_2 and O_2 in fuel and waste gases, also the delicate and somewhat troublesome explosion method for getting the H_2 and marsh gas content in fuel gases.

Calorimeters and pyrometers of various kinds on the market are described, but it would have been better if something more had been added regarding the degree of accuracy and sensitiveness expected from the various types. In correcting for the radiation losses in calorimeters of the "bomb" type, the Regnault-Stohmann formula is given. The more usual method is by plotting the time-temperature curves, which is only suggested by the author. Something more might also have been said about cooling curves in calibrating pyrometers. The correct calculation of the temperature of combustion, to which a chapter is devoted, depends upon our exact knowledge of C_p and C_v, the specific heats at constant pressure and temperature, and the author takes the linear laws, $C_p = a + bT$ and $C_v = a_1 + bT$, due to Chatelier and Mallard. These relations are known to be only approximate, and therefore the temperatures are subject to some degree of uncertainty in consequence. The effect of excess air on the temperature is of great importance, and as most boiler furnaces introduce an enormous amount of excess air over that needed to oxidise the carbon and hydrogen in the fuel, the pages devoted to this are especially appropriate.

The chapter on explosion and the explosion engine (which is a commendable term for the internal combustion engine) is necessary even in a work devoted to fuel, and the elementary relations between pressure, volume, and temperature in an expanding gas are introduced for the purpose of bringing out the use of fuel in such engines. It would be unfair to expect more thermodynamics in a work of this kind, and the reader must look elsewhere for a thorough treatment of the cycles, etc. It is our pleasure to commend this as an admirable book, quite up to date, and we have nothing to criticise in regard to accuracy, and but little on the score of insufficiency. Dr. Brislee has well kept in mind the actual needs of the practical chemist, who will find it a valuable aid, and the student will welcome it as something better than the dry-as-dust text-book.

(2) Whatever we may think of the commercial future of the Diesel engine, it is certainly the most efficient heat engine considered from a thermodynamic point of view. With the high compression employed, it confirms in a remarkable degree the theory of efficiency based upon the compression ratio. The commercial efficiency however is quite another thing, and notwithstanding the commendable faith of the author and the inventor

(who contributes an introduction), we think that many may conclude to reserve judgment for the present. The book is an *ex parte* statement of the merits of the engine, and we are inclined to think that the author has somewhat overstated his case. It is, however, a very readable work, dealing as it does with much that is new and which has an element of originality and novelty doubly welcome in works dealing with heat engines. Much of it is given up to interesting mechanical detail of engines actually constructed, and those who appreciate the mechanical difficulties incident to high compression and temperature will admire the ingenuity displayed in overcoming the troubles that would otherwise prevent the extensive adoption of the engine. And to a great extent the difficulties for small engines have been overcome to a degree which the reader will appreciate.

After an outline of the various cycles and efficiencies of heat engines, the action and working of the Diesel engine is described. Apparently experience does not yet point to the exclusive adoption of either the two- or four-cycle engine, but it is stated that for powers up to 600 or 700 horse-power the four-cycle engine will be employed for land purposes, and above that power the two-cycle. But perhaps the chief interest in the engine centres in its use for marine propulsion, and the latter half of the book is devoted to this application. With a fuel consumption of about half a pound per horse-power, it becomes a serious rival to the steam engine. Nor does the fuel consumption per horse-power increase for partial loads to such an extent as with steam engines according to figures quoted. The saving of space, always of importance on board ship, will necessarily depend upon the horse-power per cylinder of the engine, but notwithstanding the auxiliaries required in the form of air compressors for injecting the fuel and those installed for scavenging in the two-cycle engine, a considerable saving of space otherwise taken up by boilers might be expected. The issue of this book is timely, coming as it does so soon after the arrival of the Diesel-engined vessel *Selandia* in the Thames while we were in the midst of a coal strike.

(3) To deal with the numerous papers read before the American Institute of Chemical Engineers which are recorded in this volume would take us too far, for they cover a wide range of subjects embraced under the generic title of "chemical engineering." The president, Mr. McKenna, contributes an interesting paper on the evolution of Portland cement processes, in which the stupendous change brought about by the introduction of the rotary kiln is shown, both by the amount of cement made and its quality. Those who recall the days of the bottle kiln in the United States, with its intermittent operation, can appreciate the advantages of the rotary kiln, with its continuous process and uniform product, as used in the great cement works of that country. The quality and price of the Portland cement thus made are such as to enable it to compete successfully with "natural" (or "Rosendale") cement, when the lower tensile strength of these latter cements is considered. But perhaps even more interesting is the conversion of the slag heaps from blast furnaces into cement, which has been rendered possible by the high heat of the rotary kiln. It is stated that the manufacture of cement by the United States Steel Company is so large that it is rapidly becoming the largest factor in the business. The education of the chemical engineer is made the subject of a report by a committee. One observation bearing upon technical education in the United States and Germany is worth recording, viz., that "wits" are worth more than technical knowledge generally, and "that too much effort is devoted in the schools to training the mind in a philosophical way, and too little in training what we are to call the wits."

Incandescent lamp manufacture is treated by Mr. Myers in a paper describing the manipulation of refractory elements. These refractory elements, particularly tungsten, are employed for the reason that the intensity of the light emitted varies as the twelfth power of the temperature, while the energy supplied varies only as the fifth power, so that better efficiency can be obtained from a substance that can be burned at high temperatures. Carbon has the disadvantage that the vapour tension resulting at high temperatures is such that the operating temperature must be reduced to such a point that the efficiency is less than half that of the best metallic filament.

In a paper on the manufacture and industrial applications of ozone, Mr. Linder describes the Berthelot process used for the commercial production of this gas. Electric ozonisers produce ozone theoretically in direct proportion to the wattage of the discharge per unit of air ozonised, but the destructive action of the heat on the ozone makes the production less. It is only at about 8000 to 10,000 watts that the production of ozone becomes economical. The author believes that ozone will ultimately supersede formaldehyde in hospitals as a disinfecting agent, as recent experiments have shown it to be so suitable for the purpose. Experiments have shown that milk, cream, and butter can be completely sterilised, also other articles subject to decay. A paper on the loss in coal due to storage of (1) change in calorific value, (2) change in weight, and (3) ten-

dency to disintegrate by slacking, gives the results of experiments from which it appears that coal of the kind tested (Illinois) rapidly reduces in size of lump with time. The change in calorific value was in all cases less than 2 per cent., and in one sample only 0·38 per cent. A number of other papers make up the volume, among which are nitric acid manufacture and sewage disposal.

(4) On this sheet, measuring 40 × 30 inches, Mr. Marsh has plotted diagrams for designing and checking members of reinforced concrete under direct compression, according to the rules laid down in the second report of the joint Committee appointed by the Royal Institute of British Architects and the London County Council draft regulations. By means of the diagrams, it is possible to design the column or strut for a total load with an assigned ratio of longitudinal reinforcement, and to obtain the appropriate hoop reinforcement. The diagrams will thus prove valuable for engineers designing compression members in reinforced concrete, and the only criticism that might be made would be the somewhat bulky form of the sheet. As the results of using the diagram would be in accordance with the above regulations, its utility ought to be quickly recognised by busy engineers.

(5) The introduction of electric and electro-pneumatic signalling arrangements on railways has given rise to a special branch of engineering, and it is to the engineers and students engaged in that department that Mr. Lewis addresses this volume. It will not appeal to engineers generally, though there is much ingenuity displayed in the design of modern signal systems which would attract a man with a mechanical turn of mind. The book is illustrated by excellent drawings, and the descriptive matter is well chosen. The author is lecturer on railway signalling at the Glasgow and West of Scotland Technical College, and is on the staff of the Caledonian Railway.

KAINOZOIC STRATIGRAPHY.

Traité de Géologie. By Prof. E. Haug. II., Les Périodes géologiques. Fascicule 3. Pp. iv + 1397–2024. (Paris: Armand Colin, 1908–1911.) Price 11 francs.

THE third fascicule of Prof. Haug's "Traité de Géologie" completes this valuable text-book with an account of the post-Cretaceous formations. The author's treatment of the subject, as in the previous parts, is marked by the special importance given to the varying bathymetric conditions under which different parts and areas of a formation have been laid down. The present volume is also of interest as it presents a modern French classification of the post-Cretaceous rocks. Prof. Haug does not use the term Kainozoic, and does not adopt any one term for these formations. He divides the post-Cretaceous time into three eras: the Nummulitic, the Neogene, and the Quaternary. He has abandoned the generally accepted five periods, and rejects Lyell's nomenclature altogether. British geologists will probably not follow this course unless the reasons for the change are quite convincing.

The Nummulitic and the Neogene are grouped together by Prof. Haug as the Tertiary, and both its lower and upper limits are ill-defined. He includes the Montian in his Nummulitic, and he explains its rich fauna of Cretaceous bryozoa and brachiopoda in the Tuffeau de Ciply as fossils derived from older limestones. As the Danian is left in the Cretaceous, the author admits an imperceptible stratigraphical boundary between the Cretaceous and the Nummulitic, in spite of the sudden change of fauna. Both the two divisions which Prof. Haug refers to the Tertiary he divides into three sections. His Eo-Nummulitic includes the Montian, with the Thanetian and the Londonian, of which the typical deposits are the Lower London Tertiaries. The Meso-Nummulitic ranges from the Lutetian to the Ludian, the section above the Barton clay. He rejects the Priabonian as a widespread horizon, and appears, on p. 1475, to limit it to the Alps, though he subsequently accepts it in North Africa; and its presence with other Nummulitic rocks in Cyrenaica, as shown since the publication of the volume, renders necessary the alteration of the statement (p. 1503) that there is no vestige of the Nummulitic sea between Egypt and Tunisia. The Neo-Nummulitic is practically the Lower Oligocene, and Prof. Haug quotes Tongrian and Oligocene as synonyms.

The three sections of the Nummulitic are subdivided into ten divisions, and the author conveniently gives the founder, etymology, and date of the name of each. The classification of the Nummulitic is based mainly on the foraminifera, and though Prof. Haug remarks that it may appear somewhat paradoxical to attach such weight to these primitive organisms, they are certainly among the most convenient fossils in the correlation of the Lower Kainozoic horizons.

The Neogene group Prof. Haug divides into three sections, and owing to the great importance of their representatives in the Mediterranean area, he calls them the Eo-Mediterranean, Meso-Mediterranean, and Neo-Mediterranean (p. 1607).

The Neogene includes the Aquitanian, which is often regarded as the Upper Oligocene, and ranges upward to include the Astian.

The strongest argument in support of Prof. Haug's dismemberment and abandonment of the Oligocene is derived from the importance of the Aquitanian transgression, whereby the marine rocks of that epoch advanced upon the land in many parts of Europe as well as in the Indian and Pacific Oceans. The transgression was, however, as the author admits, incomplete in the typical Aquitanian area, and the Burdigalian transgression was also of such great importance that there is much to be said for making it the separation between the Upper and Lower Kainozoic.

The post-Neogene deposits Prof. Haug groups together as the Quaternary, the name proposed by Desnoyers in 1829. He rejects Lyell's term Pleistocene on the ground that it is not euphonious, and "tout à fait" incorrect. But is Quaternary any better in these respects? Quaternarius means "consisting of four" or "containing four," as it is defined, for example, in Lewis and Short's "Latin Dictionary." The term is correctly employed in quaternion and in quaternary compounds, but not for the name of a fourth division of geological time. Should it not be Quartary? The term Pleistocene would certainly not be suitable for Prof. Haug's Quaternary group, which includes the Sicilian or Upper Pliocene of Calabria and Sicily, and also the Norwich Crag. The absorption of the Upper Pliocene in the Quaternary throws doubt on the advisability of separating that group from the Tertiary, and both may be conveniently combined as the Kainozoic.

The account of the Quaternary is mainly devoted to the Glacial period. Prof. Haug accepts a frequent repetition of interglacial periods, but makes no reference to Lamplugh's arguments against them. As in the earlier volumes the references to British authorities are scanty; thus in the accounts of the British Eocene deposits but few authorities are referred to, and the latest is a paper of 1891. The cause of the great glacial development is considered in a very interesting discussion. The author is obviously attracted by the possibility of explaining the glaciation of north-western Europe and eastern America by changes in the distribution of land and water, and by the refrigeration of the coasts of Europe when the North Atlantic continent had been sufficiently broken up to admit the Arctic waters. Prof. Haug has done good service to geology by his very suggestive and original treatise.

J. W. G.

ANALYTICAL CHEMISTRY.

(1) *An Introduction to Quantitative Analysis.* By Dr. S. J. M. Auld. Pp. x+215. (London: Methuen and Co., Ltd., 1912.) Price 5*s*. (Text-books of Science.)

(2) *Volumetric Analysis for Students of Pharmaceutical and general Chemistry.* By Charles H. Hampshire. Pp. vii+104. (London: J. and A. Churchill, 1912.) Price 3*s*. 6*d*. net.

(3) *Water Analysis for Sanitary and Technical Purposes.* By Herbert B. Stocks. Pp. viii+136. (London: Charles Griffin and Co., Ltd., 1912.) Price 4*s*. 6*d*. net. (Griffin's Technological Handbooks.)

(4) *Qualitative Organic Analysis.* By F. B. Thole. With an introduction by Dr. A. E. Dunstan. Pp. x+68. (London: Methuen and Co., Ltd., 1912.) Price 1*s*. 6*d*. (Text-books of Science.)

(5) *Methods of Air Analysis.* By Dr. J. S. Haldane, F.R.S. Pp. x+130. (London: Charles Griffin and Co., Ltd., 1912.) Price 5*s*. net. (Griffin's Scientific Text-books.)

TEXT-BOOKS of analytical chemistry may be divided into two classes, that is, those that treat more or less completely of the subject with which they deal, and those that aim at making a judicious selection of work that will serve to ground the student in the principles of the subject, and give him such practical experience as circumstances will allow. (1), (2), and (4) of the above volumes belong to the second section. The number of elementary text-books already provided for the student of chemistry is so great that one is quite justified in asking why they should be added to. Among the reasons given, most of which are unworthy, there is one that deserves more attention than it receives. Some authors seem to think that each new edition of their book must be larger than the preceding, and so the volume gradually grows until it is much too large for the purpose for which it was intended—too bulky, too expensive, and too inclusive.

This, perhaps, is justification for the publication of Dr. Auld's book (1). We think that even he inclines to cover too wide a ground in his two hundred pages, because it is better for a student to learn a little well than to concern himself in a perfunctory manner with a great deal. When such a space as this includes introductory matter, volumetric analysis, gas analysis, gravimetric analysis, separations, the analysis of sundry minerals, water analysis, and the estimation of equivalent weights and vapour densities, many operations must be merely indicated, with the result that the student has not a description of what he wants in his own book for study. The international atomic weights are

given, but the "approximate values generally used" need revision (or deletion) when they range up to a discrepancy, in the case of zinc, of more than a half per cent. The author uses a nomenclature that we consider objectionable, though of course it is not original, as in the case of the analysis of barium chloride. Here we have "estimation of barium" and "estimation of chloride." The word "chloride" is used to indicate the combined chlorine, and as this word has for some generations indicated the whole salt, a new and additional meaning is given to an old word, and this leads to confusion. Moreover, this method is not consistent because, while it tries to distinguish between free and combined chlorine, there is no attempt made to distinguish between free and combined barium.

Mr. Hampshire (2) gives the usual selection of volumetric work that is prescribed for elementary students, but his book has a special value in including, after each section, short instructions for the examination of those pharmaceutical preparations that are appropriately analysed by the method described. Mr. Thole's "Qualitative Organic Analysis" (4) contains a considerable amount of information in a convenient form. It is gratifying to see that the author aims at treating the subject "on simple and logical lines." But there are other logical methods of work, and, at the same time, simpler systems from a practical point of view, besides the one that begins with six tests for elements, and follows these with more than a dozen "additional preliminary tests," with six more to be added "if the substance is carbocyclic," before going to the "distinguishing and confirmatory tests." It ought not to be a question of the choice between this tedious method and the random guessing referred to in the introduction, and which admittedly is far too general. These three volumes have been carefully prepared and will take their places as useful laboratory text-books.

The other two volumes are not beginners' books. Mr. Herbert B. Stocks, in his "Water Analysis" (3), solves the old controversy as to the respective merits of getting at the organic matter by Wanklyn's distillation with alkaline permanganate and Frankland's combustion for carbon and nitrogen, by giving both. Similarly he gives both Clark's soap method and Hehner's titration method for hardness. A great deal of the book is very familiar reading. The author rightly says that the biological examination requires separate treatment. When he says that the microscopical examination is included, we turned with interest to this heading and were disappointed to find that only a page is devoted to it.

Dr. Haldane's "Methods of Air Analysis" (5) is a volume of an essentially different character from any of the preceding. It contains a description of methods of air and gas analysis that the author has found useful in connection with experimental work in physiology, chemistry, and hygiene. The practical details of the methods are many of them original, and the description of them gives exactly what the worker in this branch of analysis would wish to know. The larger apparatus for air analysis has a gas-measuring vessel that holds 21 c.c. and gives readings to 0·001 c.c. Absorptions are done in attached pipettes, and a control tube does away with the need for barometer and thermometer. A smaller portable apparatus allows of an error limit of ·01 per cent. Other portable apparatus for special purposes are described, such as for small percentages of carbon dioxide, and the examination of the air in mines. The recognition and estimation of small proportions of carbonic oxide in air by means of the blood test are fully dealt with. Flame methods of estimating oxygen and methane are given, and the detection of various poisonous gases and the estimation of dust are shortly described. It is a thoroughly practical book, and deals with this important subject concisely and yet fully.

OUR BOOKSHELF.

Views and Reviews. From the Outlook of an Anthropologist. By Sir Harry Johnston, G.C.M.G., K.C.B. Pp. v+314. (London: Williams and Norgate, 1912.) Price 3*s.* 6*d.* net.

In his most recent book Sir Harry Johnston has re-written several articles that have appeared in various journals and included some lectures on colonial subjects. Despite the diversity of subjects here treated there runs through all the broad views of a man who has seen much and travelled far, and an attempt to give an anthropological explanation to the matters dealt with. The foreign relations and colonial aspirations of Germany, however, do not concern us here. The opening chapter consists of an earnest appeal for the recognition of anthropology by the Government, and we hope that some of our legislators will take it to heart. The Royal Anthropological Institute has only one underpaid official, not "two paid officials" (p. 5), and the total membership is but 508; it will be a happy day when it "scarcely reaches to two thousand" (p. 8). The chapters on Ireland are of considerable interest, and contain some first-hand observations, but we doubt if portions of them will be acceptable to the Irish. Sir Harry, despite the almost universal opinion of British archæologists to the contrary, accepts the occurrence of Palæolithic man in Scotland and Ireland (p. 63), but in the following passage picturesqueness predominates over sober narration of ascertained facts:—"The westernmost Aryans, armed with iron weapons, first conquered, then intermarried

with, a dark Iberian people, who in their turn had imposed a Mediterranean speech on the still earlier Mongoloids, Australoids, and Basques of Palæolithic Ireland" (p. 74). There is scarcely a statement in this sentence which is not open to criticism. Many remarks, too, in the chapter on "Racial Problems" are on a par with this. Sir Harry is always interesting and suggestive, and the book should be widely read in spite of the fact that some of the statements do not represent the conclusions to which most anthropological investigators have arrived. Those in authority in our own Empire and in foreign countries should read the final chapter on "The Preservation of Fauna and Flora."

Trattato di Chimica Organica Generale e Applicata all' Industria. By Prof. Ettore Molinari. Second edition. Pp. xxiii+1087. (Milan: Ulrico Hoepli, 1912.) Price 18 lire.

THE first edition of this work, reviewed in NATURE in 1910 (vol. lxxxiv, p. 170), was so rapidly exhausted that within two years of its publication a new edition was called for. In preparing this, not only has the old text been carefully revised, but upwards of 100 pages of new matter have been added; the principal sections which have been enlarged are those dealing with the manufacture of coal-tar, of dyes and colouring matters, and the alkaloids; the statistical information, which was so novel and useful a feature of the first edition, has been corrected to 1910, and where possible to 1911. Some interesting information (and criticism), for instance, is given under this heading of the recent operations of the *Camera Agrumaria* in Sicily in endeavouring to control prices of the raw material of the citric acid industry. There is no doubt, as proved by the rapid exhaustion of the first edition, that such a work meets a long-felt want, and we are glad to note that an English translation by Mr. T. H. Pope is shortly to be issued; a German translation is also being prepared by Prof. Siebert.

W. A. D.

Peeps at Industries: Rubber. By Edith A. Browne. Pp. viii+88+plates. (London: A. and C. Black, 1912.) Price 1*s.* 6*d.* net.

THIS book is intended to give the general reader a popular account of the rubber-growing industry. After a picturesque account of the discovery of the utility of rubber, he is taken successively through the regions of Brazil and Central America, and made to realise vividly the conditions under which rubber is produced in each country. The sources of the different American and African wild rubbers are described, and a graphic account of the collection of gutta-percha and balata is also given. The reader then learns how Mr. H. A. Wickham succeeded under great difficulties in transporting some Para rubber seeds from Brazil to Kew, and how these have given rise to the vast rubber plantations in the Middle East. All the processes involved in the production of raw rubber are described in non-technical language, and will be readily understood by anyone.

The book is singularly free from literary slips, but the phrase "Britain, England, Holland, and Germany" (p. 42) has apparently been overlooked. The twenty-four excellent illustrations add considerably to the value of the book, which is heartily recommended to anyone desiring a non-technical account of rubber production.

Atlas typischer Spektren. By Prof. J. M. Eder and Prof. E. Valenta. Pp. xv+143+53 plates. (Vienna: Alfred Hölder, 1911.) (Kaiserliche Akademie der Wissenschaften.) Price 90 marks.

THIS publication contains the results of the study and reduction to wave-lengths of the lines in the flame, arc, and spark spectra of many of the chemical elements. In all, thirty elements are dealt with for the flame spectrum, sixty-six for the arc spectrum, and sixty-eight for the spark spectrum. In general, the region of spectrum discussed extends from about λ 2400 to about λ 7000. The lists of lines given are not overburdened with the great number of extremely weak lines which occur in the spectra of some of the elements, but this exclusion of the weakest lines does not detract from the value of the work.

In addition to the text and tabular lists of wave-lengths, there are fifty-three excellent heliogravure plates of the various spectra. On these a wave-length scale is given showing every hundredth tenth-metre. The chief lines shown in the plates have the wave-length numbers placed opposite them, which makes the identification easy, and thus greatly enhances the usefulness of the publication. The wave-lengths of the lines in the lists are given to the nearest hundredth of a tenth-metre. One has no hesitation in pronouncing this to be by far the most complete and useful collection of laboratory spectra yet published, and the library of any practical chemist, physicist, or spectroscopist will be incomplete without it.

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.*]

Some Optical Experiments.

DURING some recent work I had occasion to try the following experiments, the results of which are, I trust, of sufficient interest to be recorded in your columns.

Exp. 1.—Take a disc of white cardboard about 36 in. diameter and draw thereon a series of black rings ½ in. wide and 1 in. apart, leaving a central disc (white) 2 in. diameter. Hang this on the wall of a room fitted with a central cluster of three electric lights. Each light should be on a separate switch; one light should be of 100 cp., one of 50 cp., and one of 8 cp. With all the lights on, gaze steadily at the central white disc from a distance of 3 ft. for about fifteen seconds, when an assistant should switch out the 100-cp. lamp. The whole disc will for a moment be invisible; then the central white spot only will reappear. After an interval of about ten seconds the outer white ring will reappear, followed by the others in succession towards the centre, until the whole disc is visible.

Exp. 2.—Set up as for experiment 1, except that the 50-cp. lamp is not used. In this case, when the 100-cp. lamp is switched off, the outer rings appear first and the central disc last.

Exp. 3.—On a piece of very dark grey paper (or a well-used blackboard) about 36 in. square fasten a piece of black velvet about 9 in. square. Reduce the light in the room so that the velvet can only just be distinguished from a distance of about 2 ft. Gaze steadily at the centre of the velvet, and after about four seconds the outer edges of the paper will appear to darken. This darkness will slowly progress until the paper and velvet appear to be enveloped in an absolutely black curtain. It is interesting to note that in each of these experiments the slightest movement of the eyes or eyelids is sufficient to restore normal conditions. So far as I am able to ascertain, these three experiments have not previously been recorded. They appear to indicate that the retina depends for its action upon sensitisation from the periphery inwards; also that this sensitisation is dependent upon light falling upon the periphery.

Exp. 4.—Take an oculist's ordinary test-type and hang it on the wall of the room fitted with the three lamps previously described. Choosing a T in the 6/18 line, gaze at it steadily from a distance of about 12 in. After a few seconds the white paper immediately surrounding the letter appears to increase in brightness. At this point have the 100-cp. lamp switched off. This brightness will now increase and spread towards the terminals of the letter. At the same time the brightness takes a slightly blue tinge until, in the words of a friend who tried the experiment, "the letter appears to float in a Bunsen flame."

I should be glad if some of your readers will repeat these experiments, or if they have been recorded elsewhere give the reference. HERBERT S. RYLAND.

9 Vere Street, W., July 2.

Photosynthesis and Stomatal Aperture.

IN your issue of August 10, 1911, you were good enough to publish a brief description of my "Stomatograph" (Proc. Roy. Soc., B., vol. lxxxv., p. 33). I there pointed out that the stomatal aperture in Egyptian cotton plants under field conditions during June reaches its maximum at about 9 a.m., and that this maximum aperture is maintained for only a few hours at most, closure ensuing as the result of the severe water-strain on the root-system. Thus the stomata may be almost completely closed by noon, or even earlier.

It was highly probable that this closure would be found to provide a limiting factor on photo-synthesis by restricting the inward diffusion of carbon dioxide. It has, moreover, been noted by Thoday (Proc. Roy. Soc., B., 82) that such limitation may probably account for the low values obtained by some workers, and possibly for the fact, pointed out by Blackman, that the theoretical possibilities of carbon-dioxide assimilation have never even been approached. Since the stomata in Egyptian cotton plants are gaping wide, under intense illumination, and at high temperatures, for an hour or two in the morning, there was a further expectation that record values might be obtained. Both these expectations have been fulfilled.

The error from asymmetry of the leaves is high. Using the Sachs-Thoday stamping method, the P.E. on twenty identical pairs, each 15 cm.^{2} in area, worked out at ±4 per cent. of the mean dry-weight. The dry-weight of a square decimetre of these stamped areas is about 0·7 grams, so that with ten pairs of such areas we still have a P.E. of 9 mg.

In the effort to avoid this error I carried the number of pairs as high as 73 in a single experiment, which covered 1·6 hours, centred on 9·43 a.m., and gave an increase in dry-weight—without correction for translocation, if any—of 22·8 mg. per square decimetre per hour, with a P.E. of 3 mg. The mean shade temperature was about 28° C. only.

Results of greater interest were obtained by series of hourly determinations, which in two cases were successfully carried from 8 and 7 a.m. to 6 p.m. Ten pairs, each 15 cm.^{2} in area, were employed in the first set, and twenty, each 10 cm.^{2} in area, in the second set. The results are as follows:—

	7–8 a.m.	8–9	9–10	10–11	11–12	12–1	1–2
(1)	+12·4	+22·3	+26·8	+20·7	+ 7·3	− 6·8	+ 8·3
(2)	—	+23·7	+39·9	+29·7	+13·4	+25·9	+21·5

	2–3	3–4	4–5	5–6 p.m.
(1)	+17·6	− 5·7	+29·7	+1·3
(2)	− 3·3	−28·2	− 5·8	−7·6

It will be noticed that in the first set the sustained rate from 8 to 11 a.m. works out at 23 mg. (P.E. 5 mg.), while in the second it amounts to 25·7 mg. (P.E. 2½ mg.) from 8 a.m. to 2 p.m. It seems quite certain that values of 25 mg. per square decimetre per hour are attained by cotton plants in Egypt; these values are 25 per cent. higher than have formerly been recorded, with known probable error.

Turning to the effect of stomatal closure, it is quite clear that assimilation is very greatly reduced, if not inhibited entirely during the afternoon, by this closure. The data quoted above do not plot out to a smooth curve, partly on account of the high asymmetry of the leaf, and partly from the idiosyncrasies of individual plants, although the latter error was reduced in the second series by using twenty different plants, instead of three or four, for each hourly group.

Comparing these curves, such as they are, with the records from stomatograph and thermograph, we find that assimilation seems to be limited by temperature until about 9 a.m., and then by stomatal aperture for the rest of the day. Even when the stomata are widest, the intake of carbon dioxide is not sufficient to follow the temperature up to its maximum of 35° to 42° C.; during the afternoon the plant is starving.

W. LAWRENCE BALLS.

Gezira House, Cairo, July 3.

Curie's Constant in the Ferromagnetic State.

IN reference to my brief letter on this subject appearing on July 18, I should like to say that while the relative values of Curie's constants for iron and nickel agree with those of the analogous constants in the ferromagnetic state, the absolute values in the two states are connected by a factor of the order of 10^6, and the constants are only independent of the temperature each for its own state.

July 29. J. R. ASHWORTH.

Elliptic Functions.

I VENTURE to appeal for information as to tables of elliptic functions of the second kind, those by which the lengths of elliptic arcs are evaluated. The best tables accessible to me are those in Dale's very useful book, "Five-figure Mathematical Tables," and these are too brief for my purpose.

I have failed to obtain Legendre's original tables. But surely these have been reprinted, either in full, or in a shape more detailed than that I have mentioned. Possibly there may be a French or a German edition, failing an English one. I shall be grateful for any definite information. C. T. WHITMELL.

Hyde Park, Leeds, July 27.

THE PYGMIES OF NEW GUINEA.[1]

MAFULU is the Kuni (Melanesian) pronunciation of Mambule, the name of a group of Papuan-speaking mountaineers who occupy the crests dominating the head waters of the St. Joseph River. Although the boundaries of their territory cannot be regarded as accurately ascertained, a glance at the map shows that it extends within a short distance of the watershed of the main range, and it is likely that no substantially different people intervene between them and the tribes occupying the sources of the Aikora and other northward flowing streams. This probability is borne out by the results of Mr. Monckton's expedition to Mount Albert Edward by way of the valley of the Upper Chirima, one of the affluents of the Mamba River on the northern slopes of the main range, for, as Mr. Williamson points out, there are many similarities between the implements of the Kambisa villagers described by Mr. Monckton and those made and used by the Mafulu, while their languages are the same, or at least closely related. In any case Mr. Williamson is to be congratulated on having produced the furthest inland account yet published of any Papuasian people, and all students of the Pacific will be grateful to him for this.

FIG. 1.—Row of killed pigs at big feast at village of Amalala. From "The Mafulu Mountain People of British New Guinea."

The people Mr. Williamson describes are short, muscular mesaticephals, with "a very marked tendency to brachycephaly."

Their hair is frizzly, and generally dark brown, often quite dark, almost even approaching to black, and sometimes perhaps quite black. But it is frequently lighter; and indeed I was often, when observing men's hair lit up by sunshine, impressed by the fact that its brown colour was not even what we should in Europe call dark. I often saw marked variations in the depth of hair colour on the same head of the same individual. I saw no examples of the comparatively straight or curly type of hair which is found in the Pokau district and elsewhere.

These characters lead Mr. Williamson to consider that there is a strong negrito element present in the Mafulu, and though it does not seem necessary to assume this in order to account for the facts, the discovery of pygmies in Netherlands New Guinea greatly strengthens his position. The Mafulu live in "small groups or clusters of villages or hamlets," called by Mr. Williamson a community, the members of which regard other communities as outsiders. In spite of this the relationship between all the villages in a community is not identical, for the Mafulu have a clan system, and each clan has its own "villages or sometimes one village only." Further, each "village" consists of a single clan and no one clan occurs in more than one community.

But the relationship between a group of villages of any one clan within the community is of a much closer and more intimate character than is that of the community as a whole. These villages of one clan have a common *amidi* or chief, a common *emone* or clubhouse, and a practice of mutual support and help in fighting for redress of injury to one or more of the individual members; and there is a special social relationship between their members, and in particular

1 "The Mafulu Mountain People of British New Guinea. By Robert W. Williamson. With an Introduction by Dr. A. C. Haddon, F.R.S. Pp xxiii+364+plates. (London: Macmillan and Co., Ltd., 1912). Price 14s. net.

"Pygmies and Papuans: The Stone Age To-day in Dutch New Guinea." By A. F. R. Wollaston. With Appendices by W. R. Ogilvie-Grant, Dr. A. C. Haddon, F.R.S., and S. H. Ray. Pp. xxiv+352+plates and maps. (London: Smith, Elder, and Co., 1912). Price 15s. net.

clan exogamy prevails with them, marriages between people of the same clan, even though in different villages, being reprobated almost as much as are marriages between people of the same village.

Mr. Williamson could discover no trace of totemism, nor "any idea which might be regarded as having a totemistic origin," nor could he find any trace of mother-right, and a youth owes no special service to his maternal uncle, and even when he assumes the perineal band his mother's relatives are of no special importance.

There are thus marked differences between the Roro and Mekeo tribes and the mountaineers of the hinterland, and this difference is emphasised by the absence of any elaborate system of chieftainship, such as is found among the dwellers of the plain.

On the other hand, the "Big Feast," most carefully described by Mr. Williamson, has so many common features with the *tabu* feast of the Motu and kindred tribes, and even with the *toreha* and similar feasts of the Massim, that this resemblance cannot be accidental. All these appear to be *Rites de Passage*, by which the dead are more or less permanently and successfully dismissed from the sphere of the living and segregated in the "other world." Like the *walaga* feast of the Bartle Bay tribes, the "Big Feast" is arranged and prepared for long beforehand and held at quite uncertain periods; a further similarity is that there is now no known occasion or event in reference to which it is held, yet the clue is given by the decking of the village with the bones of important men, by the formal destruction of the grave-platform of a chief, and by the dipping of the long-bones in the blood of pigs, which are then used to anoint with blood the skulls of chiefs and big men, after which, though these skulls may be hung in the clubhouse, they will never again be used in any ceremony.

Space permits of reference to one other matter only. Few who know this part of New Guinea and read Mr. Williamson's cautious presentation of the evidence will hesitate in accepting a suggestion made to him by Father Clauser, namely, that while the slow shuffling, dancing steps of the plainsmen imitate the dancing movements of the goura pigeon, the livelier hopping and zigzag progress of the Mafulu mimic the livelier movements of the red bird of paradise.

While other travellers besides Mr. Williamson have found evidence which may be accepted as indicating the existence of a strain of pygmy blood as far east as the eastern portion of British New Guinea, no one before Mr. Wollaston and his colleagues had met an undoubted pygmy population. But although the Tapiro are brachycephals averaging only four feet nine inches in height, it does not seem sure that they are pure negritos, and culturally it is certain that they have been profoundly modified by outside influence. They build excellent houses on piles, make gardens, grow tobacco, and terrace their hills for dancing grounds; indeed, in material culture they seem to be scarcely inferior to the Papuans of the low-lying ground between the mountains and the sea. Their weapons are the bow and arrow and bone dagger; they make excellent netted bags; perhaps the latter may be the clue on the material side to the foreign influence which has made them the most "cultured" of pygmies, for similar string bags are found among the hill and mountain folk of a large part of British New Guinea, and every additional collection seems to enlarge their area of distribution. Indeed, Mr. Williamson tells the writer that the same sequence of loops is found in the network of the Mafulu and the Tapiro pygmies. Of their social system nothing could be ascertained, nor could any word of their language be recorded. Nevertheless, the supreme fact of their discovery stands forth, and our knowledge of the whole pygmy question is still further advanced by an interesting and critical *résumé* contributed as an appendix by Dr. Haddon.

FIG. 2.—Types of Tapiro Pygmies. From "Pygmies and Papuans: The Stone Age To-day in Dutch New Guinea."

It will be seen that the expedition did not learn much about the pygmies; indeed, the account of them only takes up one chapter of Mr. Wollaston's book. Two other groups of people differing little from each other were met with; that these are Papuan is proved by their physical appearance and language, the latter forming the subject of an appendix by Mr. S. H. Ray, who takes the opportunity of reviewing our knowledge of the languages of Netherlands New Guinea. How

poor Papuan culture can be will be well appreciated by reading Mr. Wollaston's description of these people, yet they use paddles for propelling their canoes, whereas it is very doubtful whether the Toro on the Bensbach River, forming the boundary of British and Netherlands New Guinea, know paddles at all, and they certainly propel their canoes in deep water by using their long bamboo punting poles as if they were paddles.

Everywhere the expedition, which was clearly too large, was hampered by a lack of knowledge of the country; a little preliminary surveying in a launch would have obviated this difficulty. Indeed, in spite of the money, some, alas! public, lavished on the expedition, the organisers seem to have made up their minds to ignore the experience of previous explorers. Much might have been done by the expedition had it been better planned, but Mr. Wollaston's book, which must be taken as the official account of the expedition, and candidly admits the blunders made, shows that the somewhat scanty results attained are not in any way due to lack of energy or *morale* on the part of the members of the party, and every reader will join in wishing Mr. Wollaston good luck and all success on his second expedition to the country towards which he is now speeding. C. G. S.

THE FIRST INTERNATIONAL EUGENICS CONGRESS.

IT is the general feeling of those who attended this Congress (which extended from July 24 to 30) that it has been a complete success. A membership of about 750 is an indication of the widespread interest taken in the subject, though an analysis of motives might reveal that the largeness of the number is partly due to other causes. In particular it can scarcely be doubted that the series of brilliant entertainments organised by the hospitality committee, under the secretaryship of Mrs. Alec Tweedie, was a bait which attracted many.

It may be useful to give some account of the general trend of opinion, judged partly by the views expressed by the speakers and partly by the behaviour of the audience, in an assembly of so many persons from so many countries, representing all those, with one or two exceptions, who hold that eugenics is a subject of serious importance.

The lead given by Mr. Balfour in his speech at the inaugural banquet in striking the keynote of diffidence and moderation was followed throughout the meeting. The application to human society of the methods found useful in the breeding pen is not advocated by the modern eugenist, neither does he wish to see permanently confined or castrated all those whom he considers undesirable mentally, morally, or physically. He does not plead for the repeal of all humanitarian legislation or for a return to "the good old days of natural selection."

He only urges that the possible eugenic or dysgenic results of fresh legislation may be seriously considered, and that the business of parenthood may be conducted by husbands and wives well informed as to their duties and regardful of their responsibilities to one another, to their children, and to the race. As a token of the feeling with regard to the latter point it may be mentioned that such phrases as "the dignity of motherhood" elicited applause as regularly as do the virtuous sentiments expressed by the heroine in melodrama.

Since the idea of practical eugenics was first mooted, its scope has naturally been much increased, so that there is room for a greater variety of views among those who pronounce a sort of general blessing on the eugenic ideal. This variety is expressed, for instance, in differences of opinion as to the relative importance of "nature" and "nurture." A regrettable result has been to debase the meaning of the word "eugenic," so that some speakers seemed to regard it as synonymous for "hygienic," whereas originally the two words were generally used in antithesis.

The presidential address by Major Leonard Darwin (which follows) was a worthy prelude to a series of papers many of which were of considerable interest and scientific importance. Among those which call for special mention are the following:—Mr. Raymond Pearl's paper on the inheritance of fecundity (in fowls); "La Fertilité des mariages suivant la profession et la situation sociale," by M. Lucien March, Directeur de la Statistique Générale de la France. M. March's work, based on the French census of 1906, adds materially to our knowledge of the subject in that he shows that although the rate of lower fertility in the higher social classes is generally true, exceptions frequently arise from the fact that other influences, such as the actual nature of the profession followed and the locality of domicile, produce definite and well-marked effects.

An admirable account was given by Mr. Bleecker van Wagenen of the preliminary report of the committee appointed by the Eugenic Section of the American Breeders' Association to study the best practical means for cutting off the defective germplasm of the human population. The eugenic legislation carried into effect by permitting or enforcing in certain cases specific sterilisation operations, in the several American States into which they have been introduced, was described, but not recommended. A considerable body of evidence as to the effect produced on the subject by such operations was summarised.

In conclusion, it must be said that heartiest congratulations are due to the president, Major Darwin, and to the secretary, Mrs. Gotto, on the organisation of the Congress. They have the satisfaction of knowing that the hard work involved has had its justification and reward in its successful issue. The Congress cannot fail to have a wide effect in promoting general knowledge of the aims of eugenists, and thus perhaps in meeting some of the undue criticisms which have been directed against them.

E. H. J. S.

The following is the presidential address, delivered by Major Leonard Darwin :—

Thoughts suggestive of the general principle of evolution have been in the minds of many sages for many centuries. Not only have labourers in this field been found in all countries, but this great problem has been attacked from many different sides. Descartes and Leibnitz advanced from the basis of the physical sciences; Harvey viewed it as a physiologist; Kant and Spencer as philosophers; Goethe as a poet, and Lamarck and Darwin as naturalists, or in that field of science where our present beliefs were most recently accepted. And the result of this long struggle for mental victory on the part of these and other great men was unquestionably the practically universal acceptance of the principle of evolution in all fields of knowledge in the nineteenth century. For this great international achievement that epoch will ever remain famous.

And what is this belief which is now so widespread? It is indeed one which is so simple and now so interwoven with all our thoughts that we are apt altogether to overlook its existence. A belief in evolution merely implies a belief that all changes which have taken place and which are taking place in this world are changes in which effects follow causes in accordance with unvarying laws. It is one of the consequences of our belief in this principle, rather than an example of the belief itself, that we regard the earth as we now see it—the rocks, hills, and valleys—as having been produced by the action through long ages of those same natural forces which we can still see and study in operation to-day; a field of science in which Lyell was the great evolutionary pioneer. As regards living beings, the belief that a knowledge of the changes going on before our eyes gives the key to what has taken place in the past has in like manner led to the general acceptance of the view that all animals and plants are the descendants of some primitive form or forms from which they have been produced by some slow process of change. And this is indeed what the public now generally mean by evolution; although its essential feature is in reality to be found in the creed that all objects, animate and inanimate, are subject to the reign of natural law. Savages when they hear thunder hold that it is due to the fortuitous intervention of the thunder god; and when we, on the other hand, connect it with the generation in the air of electricity by friction or other natural processes, we are, in fact, asserting our belief in this underlying principle. And such a belief we now unhesitatingly avow whatever may be our creeds concerning the ultimate governance of the universe. Certainly it is in this spirit that all questions of fact in every field of science are now being investigated, and this is what is meant by the general acceptance of the principle of evolution.

But if the essential idea of this principle is indeed so simple, wherein, it may be asked, does its importance lie? The great value of the belief that similar effects always follow similar causes lies in the fact that we are thus stimulated to endeavour to understand what has taken place in the past, and that the knowledge thus acquired gives us some power of looking into the future. Daily forecasts of the weather are now issued, and these forecasts will obviously become more and more trustworthy as our knowledge of the natural laws affecting the air and the skies become more and more perfect. If we had remained faithful to the creed of the savage as to the incalculable nature of storms, we should now have no faith in these forecasts; or, in other words, without a belief in evolution, meteorologists would never have been stimulated to make those scientific researches which have already so greatly increased our prophetic powers. And our present scientific creed is unquestionably acting in a similar way as regards the study of man and his social progress. Indeed, it now seems obvious that in a changing world our powers of foretelling the future—that is of making any forecast concerning the results of the forces now at work—must entirely depend on our knowledge of the sequence of events in the past. It is for this reason that we are attaching greater and greater importance to the study of the natural laws regulating the sequence of human events; for without any such knowledge we should in this world be marching blindfold into an unknown future. And it will in time be recognised that it is by increasing our prophetic powers that a belief in evolution has conferred its greatest benefits on mankind.

In order to make our knowledge of the evolutionary process practically useful, it is, therefore, obviously of the first importance that we should know how and why succeeding generations of mankind have resembled or differed from each other. The questions thus suggested for consideration may be divided under two main headings. In the first place it is to be noted that individually we pass on our learning and our thoughts to our juniors and our successors by writing and by word of mouth, whilst the material wealth of the nation in the form of improved surroundings is in a perpetual state of transference as time goes on. In other words, the environment of one generation is very largely dependent on the environment of the generations which preceded it; and according as we are increasing or dissipating the mass of accumulated knowledge, as we are careful or careless in the expression of our thoughts, as we add to or diminish the wealth of the nation, so is our conduct tending to make the world progressive or retrograde in this respect. No one can deny the importance of external conditions to the morals, health and comfort of mankind; and our instincts, selfish and unselfish, may be trusted to ensure a large amount of attention being always devoted to the factor of environment in the evolutionary process.

There is, however, on the other hand, another method by which each generation receives a heritage from its predecessors, and to which an adequate share of human thought has never as yet been given. With every increase in our scientific knowledge of the laws of life it becomes increasingly evident that the inborn qualities of the child are derived from its ancestors in accordance with laws which, though now but imperfectly known, are gradually but surely being brought to light. If the future is thus tied to the past in accordance with these laws of heredity, we must be entirely dependent on our knowledge concerning them when endeavouring to ascertain whether the inherent qualities of the individuals composing the coming generations will show an improvement or the reverse in comparison with our standards of to-day; and, when thus peering into the future, it is therefore evident that a mere study of the factors directly and immediately affecting our present environment, however important it may be, is wholly insufficient for our needs. There are, in fact, two great factors influencing us all through our lives, heredity and environment; and if at this congress we are chiefly concerned with the former—that is with nature rather than with nurture—it must not be assumed that little importance is attached by us to the many endeavours now being made to improve the environment of the people, an object unquestionably greatly worth striving for. If we choose natural inheritance as the field for our operations, it is partly because it is not wise to attempt to cover too much ground on

one occasion, and partly because this branch of inquiry into human affairs, being surrounded with many difficulties and having been much neglected in the past, seems now to be the one most in need of our efforts. Then, again, not only are the careers of all men largely influenced by their inborn qualities, but the surroundings which each man steps into at his birth undoubtedly in large measure depend—indeed in so far as they are under human control perhaps wholly depend—on the inborn qualities of those of their ancestors and predecessors who were instrumental in moulding that environment. Thus any steps which we may now take tending to improve the racial characteristics of the generations of the immediate future will undoubtedly benefit the countless millions of the more distant future as regards the heritage they will receive at birth in the form, not only of inborn qualities, but also of improved surroundings. To endeavour both to study the laws of heredity and practically to apply the knowledge thus acquired to the regulation of our lives, seems, therefore, to be a paramount duty which we owe to posterity.

But when we embark on such a comprehensive study of life as is here suggested, it soon becomes apparent that the history of the world is not a tale of a continuous and uninterrupted advance. Nature seems to have been making innumerable experiments, of which many proved to be failures. New species have often arisen in the long bygone ages merely, it would seem, to become extinct and to leave no living traces behind them. New civilisations have arisen from time to time and have then died away, leaving the world little or no better for the progress thus temporarily made. It is true, no doubt, that, if we take a wide enough field of view, it does appear that the world has always been slowly advancing towards a better state of things, and the teachings of science need not shake the faith that some of us hold, that this advance is destined to continue in the future. But if we confine our view within a narrower horizon, and if we look merely at our own form of civilisation, the history of the past affords us no right whatever to prophesy a continued improvement in the lot of our race in the immediate future—no, not even the right to deny the possibility of the decadence of any nation. In fact, pride in our past achievements must not make us turn a deaf ear to the warnings which come from a study of the laws of heredity. Indeed, many circumstances brought to light in recent investigations ought to force us to consider whether the progress of Western civilisation is not now at a standstill, and, indeed, whether we are not in danger of an actual retrograde movement.

No doubt we are ignorant in many respects concerning the laws under which evolution has been operative in the past. We are especially ignorant about the final causes of variations in animals and plants, and also about the effects produced by environment on the racial qualities of future generations; and there may therefore be forces now at work making for racial progress or decay of which we know nothing. There is, however, certainly one agency which has had a great influence in the past and of which much is now known, and that is natural selection, or nature playing the part of the breeder of cattle in refusing to breed from inferior stocks. This progressive agency, by continually weeding out the unfit, has always tended to make living beings more and more able to seize the opportunities offered to them by their environments. And it seems as if this forward movement had gone on during all the long ages since life first appeared on earth until recent times, when by our social methods we have been doing our best to prevent further progress being made by this same means. The unfit amongst men are now no longer necessarily killed off by hunger and disease, but are cherished with care, thus being enabled to reproduce their kind, however bad that kind may be. It is true that we cannot but glory in this saving of suffering; for the spirit which leads to the protection of the weak and afflicted is of all things that which is the best worth preserving on earth; and we can therefore never voluntarily go back to the crude methods of natural selection. But we must not blind ourselves to the danger of interfering with nature's ways, and we must proclaim aloud that to give ourselves the satisfaction of succouring our neighbours in distress without at the same time considering the effects likely to be produced by our charity on future generations is, to say the least, but weakness and folly.

The filling up of the blanks in our knowledge of the laws of life ought undoubtedly always to stand in the forefront of our programme. But our ignorance certainly does not forbid us to inquire whether our present knowledge is not sufficient to enable some steps to be taken with the view of safeguarding the race from the evil effects likely to be felt in the future as the results of our existing social policy. Certainly Sir Francis Galton, whose name we hope will ever in future be associated with the science of eugenics, a science to which he devoted the best years of his long life, declared with no uncertain voice that something should be attempted without further delay. The necessity for some action now being taken can, indeed, no longer be denied on account of the absence of witnesses, non-scientific as well as scientific, in its favour. If we tell the breeders of cattle that their knowledge of the laws of heredity is so imperfect that it is useless for them either to attempt to avoid breeding from their worst stocks or to try only to breed from their best stocks, why, they would simply laugh at us; and the number of those who now see matters as regards mankind in the same light is steadily increasing. No doubt the paramount necessity of maintaining a moral code introduces vast difficulties in the case of man which are unknown in the stock yard, and unquestionably the possibilities open to us are thus greatly limited. No doubt also our ignorance imperatively commands us to be cautious in our advance. But stagnation is to be feared as well as error; and when we see good reason to believe that some step could now be taken tending to benefit future generations, both as regards their minds and their bodies, our fears must not be allowed to stand too much in the way of our actions.

It must, however, be remembered that it is not sufficient to satisfy the students of biology and sociology in order to ensure the adoption of the needed reforms; for the knowledge which has convinced experts must be widely disseminated before it can produce this result. Again to adopt the analogy of the weather, the knowledge of the meteorologist, even if it should make him a perfect prophet, would be useless for practical purposes if his forecasts merely remained on record in his laboratory for his own edification. The elaborate system of telegraphing the weather forecasts all over the country is essential if the sailor and the farmer are to have any chance of utilising them practically. In the same way, our knowledge of the laws of heredity, however perfect it may become, will continue to be of comparatively little use as a method of ensuring the progress of mankind until it is not only widely known but actually incorporated in the moral code of the people. The man of science is right in regarding truth as a mistress to be sought for her own sake only, for in that

way, certainly, she is most likely to be captured. But it must not be forgotten that the results of the labours of many sages during many centuries will continue to be of no value to mankind in general so long as evolution is merely regarded as a principle by which to interpret the past. We must have a bridge to unite the domain of science with the domain of human action, and such a bridge forms an essential part of the structure of eugenics. Both national societies and international cooperation are needed for the purpose of spreading the light, and the efforts already made in these directions will, it is hoped, be furthered by the holding of this congress.

We may thus conclude that though for the moment the most crying need as regards heredity is for more knowledge, yet we must look forward to a time when the difficulties to be encountered will be moral rather than intellectual; and against moral reform the demons of ignorance, prejudice, and fear are certain to raise their heads. But the end we have in view, an improvement in the racial qualities of future generations, is noble enough to give us courage for the fight. Our first effort must be to establish such a moral code as will ensure that the welfare of the unborn shall be held in view in connection with all questions concerning both the marriage of the individual and the organisation of the State. As an agency making for progress, conscious selection must replace the blind forces of natural selection; and men must utilise all the knowledge acquired by studying the process of evolution in the past in order to promote moral and physical progress in the future. The nation which first takes this great work thoroughly in hand will surely not only win in all matters of international competition, but will be given a place of honour in the history of the world. And the more nations there are who set out on this path, the more chance there is that some of them will run this course to the end. The struggle may be long and the disappointments may be many. But we have seen how the long fight against ignorance ended with the triumphant acceptance of the principle of evolution in the nineteenth century. Eugenics is but the practical application of that principle, and may we not hope that the twentieth century will, in like manner, be known in future as the century when the eugenic ideal was accepted as part of the creed of civilisation? It is with the object of ensuring the realisation of this hope that this congress is assembled here to-day.

NOTES.

A ROYAL Commission has been appointed to report on the means of supply and storage of liquid fuel in peace and war and its applications to warship engines, whether indirectly or by internal combustion. The following are to be the members of the Commission:—Lord Fisher of Kilverstone, O.M. (chairman), the Right Hon. George Lambert, M.P., Sir Boverton Redwood, Bart., Sir Philip Watts, K.C.B., F.R.S., Sir H. J. Oram, K.C.B., F.R.S., Sir J. R. Jellicoe, K.C.B., Sir W. Matthews, K.C.M.G., Sir T. H. Holland, K.C.I.E., F.R.S., Sir T. E. Thorpe, C.B., F.R.S., Mr. A. Gracie, Mr. H. O. Jones, and Mr. A. F. Yarrow. The joint secretaries will be Captain P. W. Dumas, R.N., Engineer-Lieutenant C. J. Hawkes, R.N., and Mr. J. H. Narbeth.

MR. E. H. TENNYSON D'EYNCOURT has been appointed Director of Naval Construction to the Admiralty, and Mr. W. H. Whiting Superintendent of Construction Accounts and Contract Work, in succession respectively to Sir Philip Watts, K.C.B., F.R.S., and Sir W. E. Smith, C.B., who are retiring. Mr. W. J. Berry becomes Assistant Director of Naval Construction. Sir Philip Watts is to be retained as Adviser on Naval Construction.

COMMANDER EVANS, R.N., second in command, under Captain Scott, of the British Antarctic Expedition, is expecting to leave England at the end of August for New Zealand, where he will resume command of the *Terra Nova*, which will proceed to the south polar regions to meet Captain Scott and his party.

A REUTER message has been received stating that Captain Mikkelsen and Mr. Iversen, who in the summer of 1909 set out to discover the depôt of Mr. M. Erichsen and his two companions, who perished in the expedition of 1907–8, have arrived at Aalesund, and will proceed shortly to Copenhagen. The two explorers, who had not been heard of since they left the expedition on April 10, 1910, on the 76th parallel north latitude, proceeded over the inland ice to Denmark Firth, where they found a record left by Erichsen. On May 29, 1910, they began the return journey. They were subjected to terrible hardships. The dogs died one after the other, and they were obliged to shoot the few remaining animals for food. On November 29, 1910, Shannon Island was reached, where they hoped to meet Norwegian whaling boats in the summer of 1911, but the hope was vain. Having waited through the summer until it was so late in the year that no whaling boats could be expected, they left Shannon Island and went to Shamrock Island, where they wintered. Here the Norwegian fishing vessel *Sjöblomsten* found them, after they had abandoned all hope, and brought them to Aalesund. According to a statement made by Captain Mikkelsen, two reports from the late Mylius Erichsen were found in Denmark Firth. The first, dated September 12, stated that he was returning along the coast with provisions for sixteen days, while the second report, found in a summer camp, spoke of his discoveries, among which was one that the Peary Channel did not run through from sea to sea behind Hazen and Heilprin Lands, and that Navy Cliff was connected with Heilprinland. Erichsen's diaries were also recovered from Skærgaardsfjord.

THE report of the Court of Inquiry, presided over by Lord Mersey, on the loss of the *Titanic* was presented at a final sitting of the Court on Tuesday last. The finding is as follows:—The Court, having carefully inquired into the circumstances of the above-mentioned shipping casualty, finds, for the reasons appearing in the annex hereto, that the loss of the said ship was due to collision with an iceberg, brought about by the excessive speed at which the ship was being navigated. This finding, and the report itself, are concurred in by the five assessors:—Rear-Admiral the Hon. S. A. Gough-Calthorpe, Captain A. W. Clarke, Commander F. C. A. Lyon, Prof. J. H. Biles, and Mr. E. C. Chaston.

IT has been decided to place a bust of Lord Lister in the Royal College of Surgeons, and Sir Thomas Brock, R.A., is to be asked to undertake the execution of the work.

A MEMORIAL window to the late Hon. C. S. Rolls and Mr. C. S. Grace was dedicated on Friday last at All Saints', Eastchurch, Sheppey, by the Archbishop of Canterbury. The design is of two whole-length female figures with the respective legends, "Having done all to stand" and "Turn ye to the stronghold ye prisoners of hope." The inscription reads:—"To the Glory of God and in memory of Charles Stewart Rolls and Cecil Stanley Grace, Aviators, July, December, 1910. This window is given by friends, A.D. 1912."

PROF. HEINRICH RUBENS, professor of physics in the University of Berlin, has been elected president of the German Physical Society.

THE Moxon gold medal of the Royal College of Physicians (awarded every third year to the person deemed to have most distinguished himself by observation and research in clinical medicine) has been awarded to Sir David Ferrier, F.R.S., and the Murchison memorial scholarship, founded in memory of Dr. Charles Murchison, has been awarded to Dr. W. Rees Thomas.

BY the will of the late Sir James Inglis, a former president, the Institution of Civil Engineers has received the sum of 5000*l.* towards the cost of its new building now in course of erection.

THE inaugural address to the Summer School of Town Planning, which is to be held at Hampstead, is to be delivered on Saturday next by the Marquis of Crewe. The school is being held under the auspices of the London University Extension Board, and the course will extend from August 3 to 17. The lectures and demonstrations are intended to be of special value to municipal engineers, architects, and surveyors, but most of the lectures will be of interest to others who are concerned with town planning from the more general aspect of civic and economic progress.

THE sixth Pan-American Congress, in connection with the Latin-American Medical Congress and the Congress of Hygiene, is to take place at Lima from August 3 to 10. There are to be eight sections devoted respectively to anatomy and physiology; bacteriology and parasitology; medicine; surgery; hygiene; physics, chemistry, natural history, pharmacology; veterinary medicine; odontology.

THE sixth International Congress of Radiology is to be held at Prague from October 3 to 8 next, under the presidency of Prof. Julius Stoklasa, rector of the Technical High School of Prague. The Radium Institute at Vienna and the laboratories of Joachimsthal will be visited, and an exhibition is being arranged.

WE learn from *The Chemist and Druggist* that a movement is on foot for the establishment, in Bangkok, of a Pasteur Institute. It is intended that at the institute not only shall rabies be dealt with, but that attention shall be paid to bacteriology, and opportunities afforded for the study of all kinds of disease. The Minister of the Interior is to provide the building, and the salaries of the staff are to be paid by the Government.

STEPS have been taken to form sections of ophthalmology and tropical medicine in connection with the Royal Society of Medicine, and it is hoped that both sections will be in active operation by the beginning of the next session.

LOWTHER LODGE and grounds of two acres, facing Hyde Park, and having frontages to Prince's Gate and Kensington Gore, have been purchased by the Royal Geographical Society as its headquarters. According to *The Times*, the reception-rooms on the ground floor will provide accommodation for a museum, a map-room, a council-room, a reading-room, and a secretary's office. On the first floor, overlooking the gardens, are some fine rooms suitable for a library, while close to them are others which will be used as reading-, writing-, smoking-, and tea-rooms. Above these are rooms affording ample accommodation for the society's school of instruction, the map draughtsmen, and other officials of the society. The house has a good basement and extensive attics, which will provide storage for books or maps sufficient to meet requirements for many years. As the society wishes to take possession of its new premises without incurring any financial liabilities, an appeal is about to be made to the fellows to subscribe towards the cost. The society will probably enter into occupation in the beginning of next year.

A COLLECTION of 117 Hawaiian birds has been presented to the University of California by Miss A. M. Alexander, for inclusion in the California Museum of Vertebrate Zoology. According to *Science*, the collection is of especial importance seeing that, in consequence of the clearing of forest lands for cultivation in the Hawaiian Islands, some of the species represented in Miss Alexander's gift have become extinct.

THE first report of the Explosions in Mines Committee [Cd. 6307] appointed by the Home Secretary to inquire into the causes and means of prevention of coal-dust explosions in mines, although only of a preliminary character, clearly indicates that the Committee, which consists of Sir Henry Cunynghame, Mr. R. A. S. Redmayne, Captain A. H. P. Desborough, Prof. H. B. Dixon, and Mr. W. C. Blackett, intends thoroughly to test the capabilities of inert dusts to act as a substitute for water, either in those cases in which water is considered to be inapplicable or as an alternative in all cases. It gives a short account of the recent history of the coal-dust question; describes, with plans and photographic illustrations, the new experimental station at Eskmeals, in Cumberland; refers to the proposed use of stone dust as a means of preventing explosions; and concludes with an account of observations on the effect of dusts upon health. The last-named subject was specially inquired into on behalf of the Committee by Dr. Beattie, professor of pathology at the University of Sheffield. The results of Dr. Beattie's experiments on guinea-pigs, which are given in an appendix, are found to cor-

roborate Dr. Haldane's view that dusts containing no free silica are not markedly harmful, "but that dust containing uncombined silica or other hard material was exceedingly dangerous."

THIS season's excavations at Carchemish, which have been carried out by Messrs. C. L. Woolley and T. E. Laurence under Mr. Hogarth's direction, have resulted in some important additions to our knowledge of Hittite art and culture. Riverside quays have been discovered below the Citadel mound, decorated with reliefs in the style of the Cappadocian monuments, and a further series of interesting reliefs have been found along the southern wall of the great courtyard in front of the Lower Palace. On one of these the camel makes its first appearance in Hittite art, and another shows a strange deity having the body of a scorpion, eagle's wings, and bull's feet, who is associated with the Hittite Thunder god. The most interesting of the smaller finds was a part of a large clay cylinder inscribed with Hittite hieroglyphs, and it suggests the possibility of finding further native records, other than monumental inscriptions, on the site. Materials for a valuable pottery-sequence have also been obtained both at Carchemish itself and from a cemetery at Amarna, about eight miles to the south of Jerablus.

EXAMPLES of the transition between the use of stone or bone implements and those of metal are always interesting. In *The Cairo Scientific Journal* for June Mr. O. Bates describes two cases of this kind. In one the narrow chisel-shaped celts so often found in Neolithic kitchen-middens and camp sites are compared with a tool made of the horn of the *Gazella rufifrons*, which is rubbed down to a flat edge and used at the present day in the Sudan for slivering bark from trees for the purpose of making cordage. The second is an implement used in the same region for cutting coarse thatching grass. It consists of a haft of mimosa wood into which is socketed a celtiform blade of iron, which is fixed at an angle of about 20 degrees to that of the hafting, so that when the tool is grasped by a worker who bends from the hips, the iron is parallel with the ground. This tool preserves a characteristic form, which must have preceded the introduction of the curved reaping-hook, and illustrates a method of hafting probably used with some of the flat, broad-edged stone celts of Neolithic times.

THE curators of the Smithsonian Museum announce that four expeditions are now in the field collecting exhibits for the Panama-Californian Exhibition, to be held at San Diego, California, in 1915. Dr. Hrdlicka has started for the Upper Yenesei region of Siberia, whence he will visit Kiachta, in Chinese Turkestan, Mongolia, and then follow the road to Urga, and thus proceed along the old caravan route to China proper. On his return he will resume his studies of the distribution of the physical types of man in Peru. Dr. R. D. Moore and Mr. J. B. Harrington will undertake the survey of the Eskimo of St. Lawrence Island, Alaska. The fourth tour is in charge of Dr. P. Newton, who will investigate the Negritos of the Philippine Islands. The Smithsonian exhibits at the approaching exhibition thus promise to be of unusual interest and scientific value.

DR. DAVID HERON'S "Second Study of Extreme Alcoholism in Adults" (Eugenics Laboratory Memoirs xvii.; London: Dulau and Co., Ltd., 1912, pp. 95) is based on data collected by Dr. R. Welsh Branthwaite, the inspector under the Inebriates Act, and published in his report for 1909. He gives an account of 166 male and 865 female inebriates, who were admitted to reformatories between January 1, 1907, and December 31, 1909. As the number of men is insufficient for satisfactory statistical treatment, Dr. Heron has in the present memoir confined his attention to women. One of the most striking facts brought out is the close association between alcoholism as judged by committal to a reformatory and mental defect—two-thirds of the 865 women are mentally defective—and thus the problem arises, to what is this association due? The two possible causes which first suggest themselves are either that feeble-mindedness leads to drink or that drink leads to feeble-mindedness, and Dr. Heron points out that the evidence is in favour of the former of these two alternatives. A third possibility is that mental defect as much as inebriacy leads to confinement in a reformatory. If this were the case association without any necessary causal connection between mental defect and inebriacy would be found among the inmates of the reformatories. As repeated conflicts with the police are necessary to make one eligible for admission, and as such conflicts are not improbably due partly to mental defect, the third possibility suggested should receive serious attention. In conclusion, it must be pointed out that the three alternatives are not mutually exclusive.

IN an article on hybrids between Indian humped cattle and European cattle in the July number of *The American Naturalist*, Dr. R. K. Nabours shows that while the colour-pattern of Herefords and Durham shorthorns is dominant in the hybrids of the "F1" generation, traces of the zebu hump and dewlap persist in the mixed progeny. It is further evident that in the "F2" generation pure humped and pure shorthorn strains are segregated, and that when the parents are pure-bred the segregation follows the law of alternative inheritance. Humped cattle are immune to the Texas tick—the carrier of Texas fever—and there are indications that the same immunity holds good for at least the earlier generations of the hybrids.

IN *The Zoologist* for July the Rev. H. Friend suggests that certain noxious white worms of the enchytræid group, as well as some of the tubificids, which do so much harm to garden crops—celery, for instance—are annuals, and also that as the various species are short-lived, one continues the work commenced by another. In autumn, for instance, when vegetable decay sets in, the annelids on the spot commence breaking up the waste, but after egg-laying they cease to work, when the task is probably taken up by a

second, and afterwards by a third and fourth, species. The matter is clearly one demanding prompt and careful investigation.

NEW Japanese fishes of the Cyclogaster group form the subject of No. 1907 of the Proceedings of the U.S. National Museum, in which Messrs. Gilbert and Burko describe no fewer than twenty-three species. The family is affirmed to be of boreal origin, but ranges along the coasts and in shallow water so far south as the cold northern currents can be traced.

IN the July number of *The Nature Photographer* the editor bears testimony to the readiness with which the majority of owners accede to requests for permission to photograph birds on their estates, frequently also offering the invaluable services of their gamekeepers. A nest of newly hatched partridges is one of the most striking pictures in this issue.

MR. J. RAMSBOTTOM, of the Department of Botany, Natural History Museum, has published (Transactions of the British Mycological Society, 1911, reprint) a useful and interesting critical summary of works published during 1911 on the cytology of reproduction in fungi. It is greatly to be desired that specialists in other branches of botanical work should undertake the preparation of collective reviews of this kind, summarising the publications of each year, and thus recording the progress made in the various departments of the science. As the author points out, the question of sexuality in fungi is of peculiar interest, for many points arise such as have not to be considered in the other groups of plants, and there is a greater range of sexual differences in fungi than in the whole of the other members of the vegetable kingdom. In the case of each memoir which is summarised and commented upon, the author gives a brief account of previous work leading up to that under consideration, and a useful bibliography is given at the end of the paper.

THE second part of the "Flora Koreana," by T. Nakai, occupies vol. xxxi. of the Journal of the College of Science, Tokyo. Numerous new species of vascular plants are described and figured, the memoir being accompanied by twenty fine plates. Throughout the work, keys are given to the genera in each family, and to the species in each genus, with references to the synonymy and geographical distribution of each species. The greater part of the material dealt with in this extensive flora has been collected by Japanese botanists, and it is to be hoped that they will not remain content with a floristic treatment of the Korean flora, but will proceed to the ecological study of this interesting region.

A NOTE bearing on the much-debated question of the age of the earth is given in the Proceedings of the Tokyo Mathematico-physical Society by S. Suzuki. The calculation refers to the time taken for the present crust of the earth to solidify. A result is obtained on the supposition that the heat of fusion liberated by the solidification of the crust supplies the heat lost by radiation, and it is further assumed that the effect of the curvature of the earth's surface may be neglected. According to these hypotheses the calculated time varies between 30 and 300 million years, according to the kind of rock (gneiss, basalt, or granite) assumed in the calculations. The difficulty is, of course, our imperfect knowledge of the experimental data on which the conclusions are based.

WHILE the stability of the aëroplane has been successfully made the subject of mathematical investigation, some doubt still exists as to the extent to which the conclusions affect the behaviour of actual flying machines. The fact that several papers have recently appeared, treating the problem by practically the same methods, seems to indicate that the subject is beginning to receive more attention than it has hitherto received. In the *Bulletin de la Classe des Sciences* (Brussels), 1912, No. 4, Dr. Julien Pacotte gives an investigation based on forming the determinantal biquadratic for the longitudinal and lateral oscillations, but he does not discuss the particular cases which arise, except the want of lateral stability of a system without fins. The same methods were applied in a recent paper by Dr. H. Reissner, of Aachen, who, by the way, gave the first investigation of lateral *steering*. A series of papers on aëroplane stability (in Spanish) is now appearing in the current numbers of the *Revista de la Sociedad matematica española*, commencing with the March number.

IN the Bulletin of the Imperial Society of Naturalists of Moscow for the year 1911, pp. 93 to 158, Dr. E. Leyst compares the diurnal inequalities of barometric pressure in years of sun-spot maximum and minimum at Pavlovsk, Batavia, Irkutsk, Potsdam, and Greenwich. At Pavlovsk and Batavia he uses data from nine years of many and nine years of few sun-spots between 1877 and 1906. For the other stations fewer years' data are employed. A difference appears between the diurnal inequalities for both summer and winter in years of many and few sun-spots, which Dr. Leyst considers sufficiently definite to be accepted as a physical fact. Fourier harmonic analysis indicates that the difference at Pavlovsk between years of many and few sun-spots is mainly in the twenty-four-hour term. The summer data for Greenwich differ markedly in their indications from those at Pavlovsk and Potsdam, but Dr. Leyst is disposed to ascribe this to exceptional conditions at Greenwich, possibly its maritime position. If one takes the diurnal inequalities given for the individual months of the year at Pavlovsk, one finds that in five months of the twelve the range was greater in the sun-spot minimum years, though both summer and winter half-years show the maximum range in years of sun-spot maximum. In December, as Dr. Leyst himself remarks, the excess of range in the sun-spot minimum years was exceedingly prominent. Considering the differences between January and December at Pavlovsk, and between summer at Potsdam and Greenwich, evidence seems desirable that the phenomena are really representative of normal average conditions.

IN *Symons's Meteorological Magazine* for July Dr. Mill, in discussing "The Rainfall of June," directs

attention to the regular publication of tables containing systematic information regarding the rainfall for the preceding month. The stations in question are so uniformly distributed that the mean of the values gives a fair approximation to the general rainfall over the British Isles. Out of fifty-five stations quoted all except two had falls exceeding the average, at eighteen more than twice the average fell, and at Cardiff the fall was nearly three times the average. Dealing with the percentage of the average generally, England and Wales had 186, Scotland 156, Ireland 193, and the British Isles as a whole 180 per cent. An interesting article on the weather of the same month, by Mr. F. J. Brodie, shows that with the exception of one short fine spell in the south-east the weather was of a continuously broken character, and that thunderstorms were unusually frequent. "The generally unsettled character of the weather was due to the almost constant extension over these islands of large cyclonic systems from the Atlantic." In many instances the centres of the disturbances passed directly across the United Kingdom.

THE researches on fluorescence and phosphorescence which have been carried out at Cornell University during the last ten years by Profs. Nichols and Merritt and their pupils are summarised in a memoir entitled "Studies in Luminescence," which forms publication 152 of the Carnegie Institution. With the help of the spectrophotometer the distribution of intensities throughout the emission bands and the variation of the absorption with wave-length have been determined under as wide a range of conditions as possible, in order to provide a test of the validity of each of the theories of fluorescence and phosphorescence which have been proposed. After a careful examination of the experimental facts thus accumulated, the authors arrive at the conclusion that the theory most in keeping with them is the one first advanced by Prof. Wiedemann in 1889, and modified and extended by Wiedemann and Schmidt six years later. According to this theory some chemical or physical change (probably dissociation) takes place in a luminescent body during excitation, and the return of the substance to its normal condition, which may last for some time or be over in an instant, is accompanied by emission of light.

IN the June number of the Transactions of the Chemical Society Dr. T. M. Lowry describes some interesting observations on the production of nitrogen peroxide on passing air through an ozoniser and electrical spark-gaps, either in parallel or in series, in accordance with the process devised in 1903 by Leetham for the production of a bleaching gas suitable for the treatment of flour. It is shown that, whereas in air which has been subjected either to the action of the ozoniser alone, or to the spark-gaps only, no trace of nitrogen peroxide can be detected by means of the absorption spectrum, in the Leetham gas, which has been submitted to both forms of discharge, the concentration of the peroxide is as high as 1/4000. Not only is this concentration attained by passing ozonised air through the spark-gaps, but, contrary to what had been anticipated, the same result is obtained by passing the air through the spark-gaps first and then through the ozoniser. This novel function of the ozoniser is the more remarkable because ready-made nitrogen peroxide is completely bleached on passing it through the machine, probably owing to oxidation to nitric anhydride, N_2O_5. A similar concentration of the peroxide is also obtained on passing the two air currents in parallel and subsequently mixing the gases. The conclusion is drawn that the sparking of air gives rise to "atomised" nitrogen ($N_2 \rightarrow 2N$) which is capable of combining directly with ozone. It is, however, to be noted that this "atomised" nitrogen behaves somewhat differently from the "chemically active" variety of nitrogen obtained recently by Prof. Strutt under somewhat different conditions, which does not appear to combine with ozone to form oxides of nitrogen.

JOURNAL vii. of the British Fire Prevention Committee (published at 42*s*. net) contains the results of fifty-eight tests on the fire-resistance of doors and shutters. The results are presented in the form of four tabulated summaries, and included are illustrations from photographs of some of the tests. The reports state bare facts and occurrences, and are not to be read as expressions of opinion, criticisms, or comparisons. The information given is certain to be of great value to all engaged in the design or construction of buildings. Thus we extract the following particulars from the table of tests for "temporary protection." A solid-framed teak door, $1\frac{7}{8}$ in. thick, 6 ft. high, and 2 ft. 5 in. wide, failed at twenty-four minutes by flame showing between the bottom edge of the door and the sill. After forty-nine minutes flame showed between the edge of the frame and the stile of the door above and below the lower bolt. After fifty-four minutes, smoke issued through joints of the panels and centre rail. After sixty minutes the flames burst through all joints, and the door collapsed five minutes afterwards. The maximum temperature was 1975° Fahr.

Engineering for July 19 contains an illustrated account of a new type of ship for the transport of submersible boats, designed by Messrs. Schneider and Co., Creusot. The hull of the *Kanguroo* has a central portion built in the shape of an ordinary type of floating dock, and carries the submersible boat. The aft part of the ship contains all the engines, boilers, the men's quarters, &c. The forward part contains a tunnel or covered canal, forming an extension of the dock portion, and is closed by a movable stem; this part also acts as a levelling caisson to put the ship on an even keel. A series of sluice-valves and drain pumps serve to vary at will the draught of the vessel when shipping or unshipping, the draught being so regulated as to allow the submersible to float through the tunnel. When the submersible is in the compartment amidships, it is shored up, the movable stem is replaced, and the water is pumped out of the dock, which then forms a dry dock of the usual type. The first submersible boat to be transported in the *Kanguroo* was the *Ferre*, built by

Messrs. Schneider for the Peruvian Government. The *Ferre* was shipped in the *Kanguroo* in Toulon Harbour on June 28 last, and is now on her way to Callao.

MR. HENRY FROWDE will shortly publish as a permanent memorial of the recent celebration of the 250th anniversary of the Royal Society a volume of collotype facsimiles of the signatures of the founders, patrons, and fellows of the society recorded in its first journal-book and the charter-book from 1660 to the present time. The work will contain a preface by Sir Archibald Geikie, the president. The same publisher has just issued the third edition, revised and rearranged, of "The Record of the Royal Society of London."

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES FOR AUGUST:

August 2. 8h. 0m. Jupiter stationary.
7. 4h. 58m. Saturn in conjunction with the Moon (Saturn 6° 0′ S.).
10. 14h. 39m. Neptune in conjunction with the Moon (Neptune 5° 37′ S.).
13. 0h. 31m. Venus in conjunction with the Moon (Venus 2° 13′ S.).
,, 3h. 54m. Mercury in conjunction with the Moon (Mercury 8° 31′ S.).
14. 3h. 50m. Mars in conjunction with the Moon (Mars 1° 32′ S.).
20. 1h. 10m. Jupiter in conjunction with the Moon (Jupiter 4° 44′ N.).
21. 22h. 0m. Mercury in inferior conjunction with the Sun.
24. 9h. 50m. Uranus in conjunction with the Moon (Uranus 4° 26′ N.).
26. 23h. 0m. Saturn at quadrature to the Sun.
30. 0h. 0m. Jupiter at quadrature to the Sun.
,, 19h. 0m. Mercury stationary.

OBSERVATIONS OF NEW STARS.—A paper, full of important observations and suggestions, is published by Prof. Barnard in No. 8, vol. lxxii., of the *Monthly Notices*, in which he discusses his observations of Nova Lacertæ, Nova Geminorum (No. 2) and some other stars.

After dealing with the position and brightness of Nova Lacertæ, he describes the focal peculiarities presented by the star, at different epochs, in the field of the 40-in. refractor. At first, January, 1911, there was a normal image at the normal stellar focus, but 9 mm. beyond that there was also a well-defined crimson image produced by the very strong hydrogen, Hα, radiation. This crimson image was short-lived, and had certainly disappeared by April 9, probably earlier. Then the focus of the nova became longer, finally corresponding to that of a nebula. The stage where there existed the abnormal crimson image was also observed in Nova Geminorum (No. 2) on March 22 of this year, the difference of focus between the normal and abnormal images being 9.3 mm. Prof. Barnard suggests that it should be possible to discover novæ during this stage by sweeping for them, as one does for comets, the criterion being the focal peculiarity produced by the excessive brightness of Hα. He also suggests that, with the 40-in. telescope, there are probably hundreds of past novæ which might now be recognised by their presenting the second condition of longer focus and ill-defined appearance; examples of this class are Nova Cygni (1876), Nova Aurigæ (1891), and Nova Sagittarii (1898).

Prof. Barnard also presents some results of focal measures of several stars of different types, in which the normal image presented no peculiarities, although in several cases, *e.g.* P Cygni, he found abnormal images at some distance from the ordinary focus. Discussing the theories concerning novæ, he inclines to the one in which the outburst of the star is supposed to be produced by physical forces inherent in a single body.

THE SPECTROSCOPIC DETERMINATION OF AQUEOUS VAPOUR IN THE ATMOSPHERE.—The determination of the amount of water vapour existing in the earth's atmosphere between the observer and observed body is a matter which enters into several important astronomical problems, and therefore the paper by Mr. F. E. Fowle in No. 3, vol. xxxv., of *The Astrophysical Journal*, is of considerable importance astronomically. Mr. Fowle passed the radiations from a Nernst lamp through long columns of air, of which the quantity of aqueous-vapour content and the physical conditions were strictly recorded, and then, with a spectrobolometer, found the absorption produced by this aqueous vapour in the region of the two bands at $\lambda 1{\cdot}13\ \mu$ and $\lambda 1{\cdot}47\mu$. In the laboratory experiments it was not feasible to work beyond an amount of aqueous vapour corresponding to a depth of 0·5 cm. of precipitable water, but by incorporating the results of bolographs secured for high and low sun at Mount Wilson the curves are carried well beyond any amount of aqueous vapour likely to be met with in practice. In subsequent papers Mr. Fowle proposes to give applications of his method.

PERSONAL ERRORS IN TRANSIT OBSERVATIONS.—In his address, as retiring president, to the Royal Society of South Africa, Mr. S. S. Hough gave some most interesting particulars concerning the progressive elimination of personal error from the transit observations made at the Cape Observatory. After describing the eye-and-ear and the chronographic methods, Mr. Hough stated that the differences between two experienced observers not uncommonly amounted to 0·25s., a varying quantity fatal to the researches calling for great accuracy. Then the Repsold hand-driven travelling-wire apparatus was adapted, and when six observers used this regularly, in 1908–9, the personal discordances were very greatly reduced, so that the extreme discordance, for all the observers, was only 0·06s. On the Repsold method being used, in 1911, with the mechanically-driven web, this extreme discordance, for seven observers, was further reduced to less than 0·02s.

THE BRITISH MEDICAL ASSOCIATION

THE eightieth annual meeting of the British Medical Association was held in Liverpool on July 19 to 27. The first four days were devoted to the representative meeting, at which the representatives of the branches and divisions of the United Kingdom and the Colonies discussed various matters affecting the association, the most important being the question whether the association should make further representations to the Government in respect of the disfavour with which the Insurance Act is regarded by members of the association. After prolonged discussion, in the course of which the ill opinion of the Act entertained by the medical profession was freely expressed, it was decided by 181 votes to 21 to break off negotiations with the Government. In most cases the representatives had already been instructed as to their vote by meetings of the local divisions, at which resolutions directed against further conferences with the Government had been passed unanimously or by large majorities. It may here be observed that the medical

profession, which is often regarded as very conservative, is efficiently organised for medico-political action upon trade-union lines. The representative meeting has no executive functions, but its resolutions, confirmed in general meeting, are binding upon the council, which is elected by a postal vote upon a proportional representative basis. The association has about 25,000 members, the number of medical men in the United Kingdom being about 33,000.

The provision of sanatorium benefit met with less unfavourable consideration, the working conditions of this portion of the Act being in part determined by those of existing institutions, and being therefore less unacceptable to the members; nevertheless, the opinion was freely expressed that the advantages to consumptives anticipated by the lay Press would prove to be largely illusory.

The scientific business of the association, which did not commence until July 24, extended over three days, during which period, however, only the mornings were occupied with sectional meetings. The time of the sectional meetings was largely occupied with discussions on subjects of interest, the number of papers read being somewhat small. The difficulties attending medical research work were abundantly illustrated, as was also the important part played by the University of Liverpool in the advancement of medical knowledge, particularly in the domain of physiology, pathology, and tropical medicine.

To give an adequate idea of the character and extent of recent scientific advances in medicine, as exhibited in the proceedings of the sections, is impossible within the limits of the present article, but by way of illustration brief reference may be made to the work of two of the sections.

In the Section of Physiology, Prof. Benjamin Moore, F.R.S. (Liverpool), contributed a paper dealing with the importance of substances present in minute amount in food, the value of which cannot be estimated by the amount of heat energy which they contain and can yield to the body on oxidation. This was first observed in respect of inorganic salts, which were at one time regarded as inert constituents, or even as protein impurities, but are now known to be important activators to the functions of the organic constituents, without which these become inert. In the hormones, or internal secretions of the body, organic substances are found which, in minute amounts, stimulate and activate in a very specific way definite tissues and cause changes in nutrition out of all proportion to their mass. From recent researches it would appear to be a general rule, especially seen in man, that some form of stimulus is almost essential, and that, if abstinence or restriction is practised in one form, some other form must be substituted. The various cereal foods which appear so simple in nature also contain basic bodies in minute quantities which exert a powerful stimulant action upon the nervous tissues, and in their complete withdrawal certain well-marked results appear which are intimately connected with diseases of nutrition. These substances appear to be formed in the peripheral layers and are removed in certain methods of preparing the cereals. The effect of removal upon a diet of cereals is exhibited by beriberi in man and by the now well-known rapidly fatal illness, characterised by muscular paralysis and incoordination, first shown by Eijkman to be readily producible in pigeons. In both cases the addition of the defective substance is speedily followed by recovery. One of the active substances concerned in the case of rice has been isolated by Casimir Funk (London), and has been shown to be of relatively simple chemical constitution.

Considerable interest was exhibited in the Section of Tropical Medicine, where a series of papers, illustrating incidentally the small beginnings of exact knowledge, were contributed by Stephens and Fantham (Liverpool), Kleine (South Africa), Mesnil (Paris), Kinghorn and Yorke (Rhodesia), and Wolbach and Bruger (Boston), dealing with sleeping sickness, which at the present time, as is well known, seriously menaces the future of colonial development in tropical Africa. Another series of researches, also cosmopolitan in character, by Duval (New Orleans), Bayon (London), Marchoux (Paris), Dean (Aberdeen), and Minett (Demerara), dealt with the organisms which have been isolated from leprous lesions, the relation of which to human leprosy and to rat leprosy is now receiving the attention of scientific investigators. Considerable diversity of opinion, in respect of the significance of experimental investigations, was observable, due in part to the limitations of research.

An excellent exhibition of scientific apparatus and of synthetic products was provided, the interest of which was considerably augmented by the scientific knowledge possessed by many of the exhibitors.

PHYSIOGRAPHY OF THE PRAIRIES AND NORTH-EASTERN AUSTRALIA.

THE much-debated problem why the prairies of the United States are treeless is, according to an article by Mr. B. Shimek in the Bulletin of the State University of Iowa, new series, No. 35, essentially one for the botanist, since, despite variation in surface-conditions, there is comparative uniformity in the flora throughout the area. Summarising the available evidence, the author concludes that exposure to evaporation, as determined by temperature, wind, and topography, is the primary factor in the development of the treeless condition, and that the flora persists in the exposed areas because of its xerophytic character. On the other hand, rainfall and drainage, although important as determining the amount of moisture in air and soil, are only a secondary factor, as they may be equal in the forested and treeless areas; while the nature of the soil and the geological formation affect the matter only so far as they induce conservation of water. Prairie-fires were an effect rather than a cause, and when they did act in the latter sense were but local, while seed-dispersal, although accounting for the growth of plants, will not explain the origin and presence of the flora as a whole. Finally, such agencies as the bison and the action of the sea do not enter into the problem at all.

Passing from the prairies of the Wild West to the coast districts of north-eastern Australia, reference may be made to a remarkably interesting article on the physiography of that area communicated to the *Sitzungsberichte der kgl. böhm. Ges. der Wissenschaften* for 1911, art. 32, by Dr. J. V. Danes, who recently spent several months in the country. As is well known, this part of Australia is remarkable on account of the fact that the great "Divide" is on the rim, instead of in the heart, of the continent, where it is formed by the uniform littoral wall of an old peneplane inclining slightly to the west, and abruptly falling to the eastern coast; and likewise for the sudden flexures in the river-valleys, and their abnormal slope, accompanied by waterfalls, as they approach the sea.

Another feature is the presence of shallow lakes in an undulating area, which have been regarded by other observers as indicative of the recent formation of a new "divide," being, in fact, "cut-offs" from the head-waters of the original rivers.

While admitting a former great extension of the

Australian continent—as exemplified by the theory of a peneplane extending from New Guinea to Tasmania—Dr. Daneš cannot bring himself to accept, at all events in their entirety, the views of previous observers with regard to the establishment of present conditions. To put the matter briefly, he considers that the peneplane of eastern Australia was divided into a number of basins devoid of outlet and occupied by shallow lakes, which tended to dry up during prolonged drought, such lakes being, therefore, of independent origin, and not "cut-offs." Climatic conditions were then much more favourable to the development of an abundant flora and fauna, which will explain the occurrence of the great extinct marsupials in the Pleistocene beds of Darling Downs. Desiccation of the area led to the death of the old fauna and flora.

In this respect he is in accord with Dr. A. C. Gregory, who wrote that "there is no trace either in the Darling Downs or any other part of Queensland of any violent convulsion of nature which would be adequate to cause the total destruction of the diprotodon and co-occupants of the country, and it seems most probable that their extinction resulted from a gradual change of climate and more effectual drainage of the watercourses—aided, perhaps, by some slight changes in level." R. L.

SOME ENGLISH PUBLICATIONS ON AGRICULTURAL SCIENCE.

OF the numerous agricultural periodicals and journals published in Great Britain none is more important than the Journal of the Royal Agricultural Society, which comes out annually, and gives some account of advances that have been made in the practice or the science of agriculture during recent times. The current issue is the seventy-second volume, publication having been continuous ever since 1840; although smaller in bulk than some of the old volumes, it well maintains the high standard set by Mr. Mackenzie when he took over the editorship some four years ago.

The opening article, by Prof. T. B. Wood, gives an able summary of our present knowledge of the composition and food value of bread. Probably no single product possesses greater interest to the agriculturist than wheat, even though in many cases it has fallen to the level of a by-product, and has ceased to be the staple of the farm. The advances in milling technique have led to considerable alterations in the relative values of the different wheats; formerly a white wheat possessed chief value because it gave the whitest flour, while now a red wheat is equally useful. Recently the hard wheats of great strength have come into favour, because of their capacity for making a large loaf; these wheats are more economically produced in continental areas—Canada, the United States, &c.—than here. In general, however, flour is made from a mixture of wheats carefully graded to secure certain definite characters. This blended flour does not show the deficiencies in protein, &c., that an unblended flour would show in comparison with the whole grain, so that a usual argument in favour of brown bread loses much of its force. This paper is followed by one on the milling of wheat, by Mr. A. E. Humphries. Of the other papers, one on green crops, by Prof. Malden, is of more than technical interest, and shows that the ordinary agriculturist does not utilise as fully as he might certain plants that would be very useful to him.

An interesting investigation on ropy milk has been published by Mr. J. Golding in the Journal of the Board of Agriculture (No. 12). This is a disease of milk brought about by bacteria, and causing the milk to take on a rope-like form when poured from a jug, or to draw out into long threads, sometimes a yard in length, when taken up in a spoon. Several bacteria are known that can effect this change, and one of them, the *Bacillus lactis viscosus* of Adametz, was investigated in some detail.

The possibility of growing tobacco in England is being investigated at the Wye Agricultural College by Mr. G. H. Garrad. It is proposed to grow the crop for the sake of its nicotine, which forms an admirable insecticide, but is at present very costly for the grower. Messrs. Garrad and Edwardes-Ker conclude that extraction of the nicotine from the leaf is not necessary, satisfactory washes being obtained when the leaves are simply macerated in water. Permission to grow tobacco for this purpose could not be obtained unless the leaves could be denatured so thoroughly as to be unsmokable. The authors are at present at work endeavouring to find some method of doing this.

GRANTS FOR SCIENTIFIC PURPOSES FROM THE DEVELOPMENT FUND.

A MEMORANDUM showing advances from the Development Fund, sanctioned by the Lords Commissioners of his Majesty's Treasury, to or through the Board of Agriculture and Fisheries, up to March 31, 1912, has recently been published as a Parliamentary Paper [Cd. 6252] (price 1½*d.*). The subjoined extracts show the amounts and purposes of the grants.

(1) IMPROVEMENT OF LIGHT HORSE BREEDING.

In 1910 the Board applied for an advance from the Development Fund in respect of a scheme for the improvement of light horse breeding, and in January of the following year the Treasury, on the recommendation of the Development Commissioners, sanctioned an advance of 39,800*l.* to be expended generally on the lines of the scheme proposed by the Board.

A further grant of a sum not exceeding 1250*l.* was also sanctioned to meet the expenses of administration. In August, 1911, the Treasury, on the recommendation of the Development Commissioners, sanctioned an advance of an additional sum not exceeding 10,000*l.* for allocation before March 31, 1912, to enable county committees to purchase brood mares in time for the breeding season of 1912, the original grant of 10,000*l.* having been allocated early in the financial year 1911–12 for the purposes of the breeding season of 1911.

The Treasury, on the recommendation of the Development Commissioners, has sanctioned an advance of 40,000*l.* or such part thereof as may be required in respect of the scheme, in the financial year 1912–13.

(2) AGRICULTURAL RESEARCH.

(*i.*) *Interim Advances.*

The Board made an application for an advance of 50,000*l.* per annum from the Development Fund for the organisation of a system to aid and develop agriculture by promoting scientific research and experiment, and for the provision of technical aid and advice to agriculturists. The Treasury, on the recommendation of the Development Commissioners, has sanctioned an interim advance of such part of a sum of 9706*l.* as might be required in the financial year 1911–12 for the purpose of making the following grants:—

Cambridge University	4000*l.* for research work.
Bristol University ...	500*l.* for (1) biochemical investigations on cheese; (2) investigations on Teart land.
Yorkshire Council for Agricultural Education (Leeds University)	210*l.* for investigations of atmospheric impurities.
University College, Reading	250*l.* for general work on (1) microflora of cheese; (2) cereal selection.
South-Eastern Agricultural College, Wye	350*l.* for (1) investigations on tobacco; (2) mycological department; (3) entomological department; (4) investigations on hop resins
University College of Wales, Aberystwyth	156*l.* for botanical survey of Aberystwyth: and subsidiary inquiries.
Harper Adams Agricultural College	190*l.* for research on wart disease and finger-and-toe.
Royal Veterinary College	1390*l.* for investigations in respect of vaccination against tuberculosis and other investigations.
The Incorporated Society for extending the Rothamsted Experiments	2000*l.* for research work.
The British Dairy Institute, Reading ...	60*l.* for investigation into the manufacture of cheese from heated milk.
Woburn Experimental Station	600*l.* for experimental work.

The Treasury, on the recommendation of the Development Commissioners, has sanctioned a further interim advance to the Board of a sum not exceeding 950*l.*, or such part thereof as might be required in the financial year 1911–12, for the purpose of making the following grants: —

(1) 200*l.* to the Economic Ornithological Committee of the British Association, to enable it to continue and extend its work of investigating the feeding habits of British birds. It was made a condition of this grant that the Board should, out of its own vote, make a grant to the committee of a sum of 50*l.* in the year 1911–12.

(2) 500*l.* to the Imperial College of Science and Technology towards the current expenses of the Department of Plant Physiology.

(3) Such sum as may be necessary, but not in any case to exceed 50*l.*, to the Yorkshire Council for Agricultural Education, to defray expenses connected with Mr. T. H. Taylor's investigations into the swede midge.

(4) 200*l.* to the Midland Agricultural and Dairy College for research into the discoloration of Stilton cheese.

(ii.) General Scheme.

The Treasury has informed the Board that it had received the final recommendations of the Development Commissioners on the Board's application for the advance of 50,000*l.* per annum referred to above, and that it had sanctioned the following scheme:—

(1) *Grants to Colleges in Aid of the Extension of Advisory and Local Investigation Work.*—An annual advance to the Board of a sum not exceeding 12,000*l.* for apportionment between twelve colleges so situated as to cover the whole country.

(2) *Research Scholarships.*—An advance to the Board of a sum of 16,500*l.* for the provision of 36 scholarships of the value of 150*l.* each per annum, tenable for the period of three years; 12 to be given in 1911, 12 in 1912, and 12 in 1913. The advance will include fees of selection, and will, it is expected, be spread over the five years 1911–12 to 1915–16 inclusive.

(3) *Grants to Institutions in Aid of Scientific Research and Experiment.*—An annual advance to the Board of a sum not exceeding 30,000*l.* to provide for the carrying out of work on the following eleven subjects at the institutions specified in each case:—

(*a*) Plant physiology ...	Imperial College of Science and Technology.
(*b*) Plant pathology, mycological side	A special department of the Royal Botanic Gardens, Kew.
(*c*) Plant Breeding ...	Cambridge University and the John Innes Institution.
(*d*) Fruit Growing ...	The main centre will be at the National Fruit and Cider Institute at Long Ashton (in connection with the Bristol University), and there should be two or three subsidiary stations situated in the chief fruit-growing districts.
(*e*) Plant nutrition and soil problems	Rothamsted Experimental Station.
(*f*) Animal nutrition ...	Cambridge University and another Institute to be settled later.
(*g*) Animal breeding ...	Two institutes to be settled later. In the meantime the Commissioners agreed to a grant of 400*l.* for work on the breeding of small animals.
(*h*) Animal pathology ...	The Royal Veterinary College and the Board's Veterinary Laboratory.
(*i*) Dairy investigation ...	The University College, Reading, or another suitable institution.
(*j*) Agricultural zoology...	To be divided possibly between two universities, one being given economic entomology and the other general zoology, especially helmintology.
(*k*) Economics of agriculture	Oxford University.

The Commissioners stated that they would be prepared to consider applications for a grant of 50 per cent. of the capital expenditure required for the establishment of some of the institutions, leaving the other 50 per cent. to be raised by the institution or locality concerned, unless there were very special circumstances to justify a larger grant from the Development Fund.

(4) *Special Investigations and Researches.*—An annual advance to the Board of a sum not exceeding 3000*l.* to be allocated for the assistance of particular investigations and researches not otherwise provided for.

Provision for 1911–12.—The Treasury, on the recommendation of the Development Commissioners, sanctioned an advance to the Board of a sum not exceeding 3000*l.* to meet the expenses involved in

such parts of the scheme as could be started before March 31, 1912.

Provision for 1912–13.—The following sums have been provided in the Board's Estimates for 1912–13 :—

	£	£
Part expenses of administration, included in subhead A, salaries, wages, and allowances ...		140
Other expenses of the scheme, included in subhead G :—		
Grants to colleges in aid of the extension of advisory and local investigation work	9,000	
Research scholarships (including expenses of selection)	2,800	
Grants to institutions in aid of scientific research and experiment	20,000	
Special investigations and researches (900*l.* not repayable from the Development Fund)	3,900	
Inquiries, experiments, &c., by or on behalf of the Board (not repayable from the Development Fund)	400	
Assistance on questions of economic zoology (not repayable from the Development Fund) ...	200	
		36,300
Total provision in 1912–13 for agricultural research		36,440
Deduct—		
Annual provision already made under the Board's vote in respect of agricultural research and not repayable from the Development Fund (see above)		1,500
Amount repayable from the Development Fund and included in subhead S—appropriations in aid		£34,940

(3) FARM INSTITUTES.

The Treasury, on the recommendation of the Development Commissioners, has sanctioned an advance to the Board of a sum of 80,000*l.*, or such part thereof as might be required in the period ending on March 31, 1913, subject to the following conditions among others :—

(*a*) That only such farm institutes are established and maintained as the Board may consider necessary, having regard to the possibility and advantages of combining counties for the purpose;

(*b*) That not more than 75 per cent. of the capital cost of provision of an institute be defrayed from the Development Fund;

(*c*) That the Development Fund bear only such part of the annual cost of maintenance of a farm institute or school (including the instruction and educational facilities provided by county councils at, or in connection with, it) as may be required to make up to 50 per cent. the proportion borne by central funds, after taking account of any Parliamentary grants which may be forthcoming.

The Development Commissioners also expressed their willingness to recommend further annual advances from the Development Fund in aid of the scheme up to a total limit of 325,000*l.* for the period ending on March 31, 1916.

The sum provided in respect of the scheme in the Board's Estimates for 1912–13 (subheads L and S) is 10,000*l.* only, as arrangements for carrying out the scheme were not sufficiently advanced to admit of a definitive estimate being made of the sum required for the purpose in 1912–13.

(4) DEVELOPMENT OF FORESTRY.

The Board made an application to the Treasury for grants amounting to 95,000*l.* for the development of forestry in England and Wales, to be expended during the period from October 1, 1911, to March 31, 1914. Correspondence with respect to this application is proceeding between the Board and the Development Commissioners, but in the meantime the under-mentioned grants have been sanctioned by the Treasury.

(*a*) *Advisory Work.*—An advance of a sum not exceeding 2500*l.* per annum for a period of three years, to meet salaries and travelling allowances, at five centres to be selected for advisory work. Two of these centres (Oxford and Cambridge) to be equipped for higher education in forestry, and the remaining three centres (Bangor, Newcastle, and Cirencester) for forestry education of a lower grade.

(*b*) *Research.*—An advance of a sum of 1000*l.* per annum for two years, to enable Oxford and Cambridge to provide in each case for the salary and expenses of a research officer: and an advance of 200*l.* per annum for two years for research work outside these two universities, provided that such research is carried out at Bangor, Cirencester, or Newcastle.

The advances under this head to be conditional on the work being confined to investigations into the diseases of indigenous trees and the structure of indigenous timber, and of such exotics as have been proved or may be shown to be of commercial importance to the United Kingdom.

(*c*) *Minor Forestry Experiments.*—An advance of 1000*l.* per annum for the preparation and upkeep of sample plots on condition that the Board arrange for the selection of the plots for the local management of the experiments through the staff of the forestry centres where these plots are situated.

(*d*) *Administration.*—An advance to the Board of such a sum as the Treasury may sanction, but not to exceed 2810*l.*, for the period from October 1, 1911, to the end of the financial year 1913–14.

Provision for 1912–13.—The following sums have been provided in the Board's Estimates for 1912–13 :—

	£
Grants for education (not repayable from the Development Fund)	1000
Advisory work	2500
Research	1200
Minor forestry experiments	1000
Total provision (subhead H) in 1912–13 for development of forestry	5700
Deduct—	
Annual provision already made under the Board's Vote in respect of forestry and not repayable from the Development Fund (see above)	1000
Amount repayable from the Development Fund and included in subhead S—appropriations in aid	£4700

(5) AGRICULTURAL COOPERATION.

The Treasury, on the recommendation of the Development Commissioners, sanctioned an interim advance of 3000*l.*, or such part thereof as might be required in 1911–12 as a grant to the Board to be held by it in trust for the Agricultural Organisation Society.

(6) FISHERY DEVELOPMENT.

The Treasury, on the recommendation of the Development Commissioners, has sanctioned the following interim advances to the Board, or such portions thereof as might be required before March 31,

1913, in respect of a scheme for the development of the fisheries of England and Wales :—

(1) A sum not exceeding 600*l.* for work in connection with lobster fisheries;

(2) A sum not exceeding 3500*l.* in aid of the Board's general research work;

(3) A sum not exceeding 1590*l.* for the purpose of making the following grants or such portions thereof as might be required before March 31, 1913, to the institutions named, viz. :—

(*a*) 1240*l.* to the Lancashire and Western Local Fisheries Committee.

(*b*) 300*l.* to the Marine Biological Association in aid of their research work.

(*c*) 50*l.* to the Eastern Local Fisheries Committee in aid of their experiments in connection with the marking of crabs and lobsters.

British Beekeepers' Association.

The Treasury, on the recommendation of the Development Commissioners, has sanctioned a grant to the British Beekeepers' Association of a sum not exceeding 850*l.* as follows :—

(1) A sum of 350*l.* for an experimental apiary in some central situation, to be fitted with all modern appliances and to be used for demonstration purposes and in connection with the training and examination of lecturers.

(2) A sum equal to the income of the association for the current year, but in no case to exceed 500*l.*, for general organisation—including the training and examination of lecturers, the promotion of county associations, and the organisation of pioneer lectures and demonstrations.

THE STATE UNIVERSITIES OF FRANCE.[1]

AMONG the signs of progress to be noted is the increase in the number of students. As shown by the table, this increase has been marked during the decade 1901–10, excepting in the case of one or two of the universities. At these smaller centres a process of scholastic specialisation has been going on which promises to give them distinctive place in the general system.

Distribution of Students in the State Universities of France.

Universities.	Number of students. 1901	1910
Paris	12,289	17,602
Aix-Marseille	950	1,236
Besançon	252	242
Bordeaux	2,119	2,552
Caen	646	826
Clermont	299	275
Dijon	699	992
Grenoble	566	1,156
Lille	1,110	1,779
Lyons	2,428	2,922
Montpellier	1,610	1,965
Nancy	1,027	1,899
Poitiers	821	1,299
Rennes	1,139	2,029
Toulouse	2,040	2,828
Schools of medicine and pharmacy not included in the universities	1,135	(2)
Algiers (university schools)	771	1,442
	29,901	41,044

In the decade covered by the table the total number of students rose from 29,901 to 41,044, an increase of 37 per cent. For the University of Paris alone the increase was above the average, amounting to 43 per cent.; for the provincial universities, taken together, the increase was 33 per cent. The contingent of foreign students has contributed in a marked degree to this advance; in 1900 they numbered 1770; in 1910 5241, a gain of 196·6 per cent. during the decade. These numbers pertain to the winter sessions; in the summer sessions the number of foreigners is always greater; for instance, in 1910, it was 5800, or 559 more than in the winter session of the same year. The numbers quoted relate solely to regularly inscribed students. No account is taken of students attending public lectures at the Collège de France, the Muséum, or the Conservatoire des Arts et Métiers. This proof of the extending reputation of the universities affords just gratification to the French authorities, who dwell also upon the evidence that it affects nearly every country. Russia has the largest representation in the student body, and the German Empire, exclusive of Alsace-Lorraine, stands second in this respect.

The universities of France, like those of Germany, are highly specialised institutions in which students are prepared for professional or official careers. General education is the province of the lycées and colleges which prepare students for the bachelor's degree, a prerequisite for matriculation at the universities. Hence the distribution of students by faculties serves as an index to the changing currents of intellectual life and of university demands in France.

Distribution of Students among the Different Faculties of the State Universities of France.

Faculties.	Number of students in State universities. Jan. 15, 1901	Jan. 15, 1910
Law	10,152	16,915
Medicine	8,627	9,721
Sciences	3,910	6,287
Letters	3,723	6,363
Pharmacy	3,347	1,758
Protestant theology	142	—
	29,901	41,044

From the distribution of the students among the different faculties, as shown in the table, it is seen that law attracts nearly 40 per cent. of the entire number, and, further, that the faculty of letters has gained upon the faculty of sciences, which at the beginning of the decade had the larger registration. This increasing attendance upon the faculty of letters is due in great measure to the changing requirements of the teaching force of the secondary schools, which is recruited chiefly from the two faculties considered. Among other causes for the gain in letters is the preference of foreign students. The number of foreigners in the faculties of science rose in the decade from 278 to 1208, an increase of 334 per cent.; in letters from 215 to 1708, an increase of 694 per cent.

The increased attendance upon the faculties of letters and science is due in part to the system of bourses (scholarship funds) adopted by the Government in the early days of the Republic, with the purpose of assuring a sufficient number of candidates for the teaching service of secondary schools. At that time the faculties were purely examining juries and few candidates were forthcoming for the *licence* (diploma required for regular scholarships) or for the *agrégation* (examination for special professors). In order to induce young men of promise, but of limited means, to enter the service, Government bourses were created to be awarded upon competitive examination. The number of candidates admitted to this provision each year is, however, strictly limited, and at present the boursiers form a very small propor-

[1] Abridged from a chapter on Educational Movements in Western Europe, by Anna T. Smith, in the report of the U.S. Commissioner of Education for the year ended June 30, 1911.

[2] Included in the universities in 1910.

tion of the entire number of students in the two faculties named.

By the reorganisation of secondary studies (decree of May 31, 1902) a road is opened for primary schools to the scientific faculties through the assimilation of the modern course in the lycées to that of the higher primaries. This arrangement was made both in the interests of the teaching service of primary schools and also as a means of enabling ambitious youths among the industrial classes to prepare themselves for more effective service in the practical affairs of life.

In the reports of the financial status of the several universities the receipts are classified as the ordinary and the extraordinary income. The former comprises the revenues from property and the interest of invested funds, the fees for matriculation, lecture fees, library and laboratory fees, the receipts from university publications, the State appropriations for current expenditures, appropriations by the departments and cities, and all other sources of a permanent character. The extraordinary income includes gifts and legacies, loans, appropriations for building or other special purposes, and all other funds intended to meet temporary demands. Each faculty comprised within a university has its own separate budget. The salaries of all professors are paid from the State appropriations, estimates for the same being annually submitted to the Chamber of Deputies by the Minister of Public Instruction. The university may, however, make arrangements for additional service to be paid for out of its own resources.

In giving up to the universities the receipts from fees, which were formerly turned over to the State Treasury, it was decided that they must be applied wholly to objects of immediate advantage to the students, such as the equipment of laboratories, libraries, new buildings, &c. Apart from these specific limitations, the universities have free disposal of their resources.

It appears that the combined incomes of the fifteen universities in France, excluding Algiers, in 1906 aggregated 530,000*l.*, of which amount Paris received 273,000*l.*, or a little more than half the total. In 1909 the amount was 448,000*l.*, of which Paris received less than half, namely 189,000*l.* Partial statements for intervening years indicate that the decline in the incomes, total and particular, in 1909, as compared with 1906, is due to fluctuations in the amounts received from gifts, legacies, &c., or what are termed extraordinary sources, rather than to a falling off in the receipts from ordinary sources. The latter include fees and State and local appropriations, which, as a rule, increase from year to year. From official statements for the years intervening between 1906 and 1909, it appears that Paris reached its maximum income in 1908, namely 313,000*l.*

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

LONDON.—Mr. H. Maxwell Lefroy has been appointed professor of entomology at the Imperial College of Science and Technology.

THE following appointments have been made at Bedford College for Women:—Assistant lecturer in mathematics, Dr. H. B. Heywood; assistant in mathematics, Miss M. Long.

UNIVERSITY COLLEGE GUILD OF GRADUATES.—The following are among the officers appointed for 1912–13:—Master, Dr. T. Gregory Foster; Engineering Warden, Mr. E. S. Andrews; Medical Warden, Mr. R. Johnson; Science Warden, Miss E. N. Thomas.

PROF. A. V. DICEY has retired, after a tenure of office of thirteen years, from the principalship of the Working Men's College, London, and is succeeded by Sir C. P. Lucas.

EAST LONDON COLLEGE.—Dr. J. Robinson, of the University of Sheffield, has been appointed senior lecturer in the physics department, and Mr. J. Salisbury, Quain student at University College, lecturer in the botanical department.

UNIVERSITY COLLEGE.—Mr. E. Kilburn Scott has been reappointed lecturer in electrical design, and Mr. A. H. Barker has been reappointed lecturer in heating and ventilating engineering. Mr. Lloyd-Evans has been appointed demonstrator in the department of mechanical engineering. Mr. F. J. Bridgman has been appointed assistant in the department of zoology and comparative anatomy. Miss K. V. Ryley has been appointed to the Benington memorial studentship in anthropometry and craniology. A valuable collection of British Lepidoptera, made by the late Mr. J. A. Finzi, has been presented by Mrs. and Miss Finzi to the zoological museum.

THE foundation-stones of the new Gresham College were laid on July 24. The ceremony was followed by a luncheon in the Mercers' Hall, at which Sir Archibald Geikie, P.R.S., spoke. He stated that he saw no reason why the new college should not become a higher centre for literary and scientific cultivation for the City of London than heretofore, and all for the glory of God and to the memory of Sir Thomas Gresham.

THE following appointments have been made at the London (Royal Free Hospital) School of Medicine for Women:—Dr. F. Wood-Jones, demonstrator in anatomy, St. Thomas's Hospital Medical School, to be lecturer and head of the department of anatomy; in succession to Mr. F. G. Parsons, who has resigned; Mr. J. A. Gardner to be lecturer in organic chemistry and head of the department of chemistry, in succession to Miss C. Evans; Miss Widdows to be lecturer in organic chemistry; Miss M. D. Waller to be demonstrator in physics.

SHEFFIELD.—Mr. H. Nield has been appointed demonstrator in anatomy, and Dr. E. F. Finch and Mr. P. A. Reckless honorary demonstrators in the same subject.

IT is announced in *Science* that the sum of 50,000*l.* has been bequeathed to Yale University, without any restrictions, by Mr. C. D. Borden, of New York.

WE are informed that the establishment of the new university in Western Australia is progressing satisfactorily, and the Senate is open to receive applications for the filling of eight professorial chairs. Parliament has voted an annual minimum endowment of 13,500*l.* towards the administration and needs of the university, and the chair of agriculture has been fully endowed by the newly appointed Chancellor, Sir W. Hackett. Mr. H. Gunn, who carried out similar work in South Africa with success, has been appointed organiser of the university, and is now actively engaged in making preparations for the inauguration of the institution early next year.

THE London County Council has decided to increase its annual grant to the Imperial College of Science and Technology from 8000*l.* to 13,000*l.*, for the quinquennial period September 1, 1912, to August 31, 1917. The report of the Higher Education Sub-committee, in which the recommendation now adopted was made, points out that the Treasury has decided to allow to the governing body of the Imperial College additional grants of 5000*l.* in respect of each of the sessions

1910–11 and 1911–12, and of 10,000*l.* (making 30,000*l.* in all) in the session 1912–13. The Treasury has agreed further that the annual grant in aid of the college shall be fixed at 30,000*l.* for a period of five years from August 1, 1912, to July 31, 1917. The Board of Education has received an assurance on behalf of the governing body of the Imperial College that the additional grant of 10,000*l.* commencing from August 1 next will, with their other resources, enable them to carry on the educational work on which they are now engaged, and also the educational work which they are committed to undertake in the new buildings now in course of erection, until the close of the session ending July 31, 1917, and the Board further understands that the governing body are prepared to abide by the condition that they shall strictly regulate their expenditure by their assured income, and that they will not during the period named commit themselves to any fresh work which might involve a demand for further State assistance.

THE London County Council has issued a pamphlet setting out the arrangements made for the session 1912–13 in connection with the various lectures and classes established by the Council for the further education of teachers. These lectures, which are free, upon payment of a registration fee of 1*s.*, to all teachers actually engaged in teaching in the County of London irrespective of the institutions in which they are employed, offer a wide choice of subjects and are designed to appeal to the many and varied interests of the teaching profession. The lectures will be of great value to teachers who desire to specialise in some one branch of knowledge or to improve their general culture. Every conceivable subject likely to appeal to teachers seems to have been thought of by the organisers, and lecturers of high repute have been secured. Some of the arrangements made in the case of science may be mentioned. Three courses of three lectures each, under the direction of the Zoological Society, will be given in the Zoological Gardens at Regent's Park. Prof. Hewlett will lecture on bacteriology and microbiology; Prof. F. E. Fritsch on modern methods of teaching nature-study; Prof. Dendy on nature-studies from animal life; and Prof. H. Kenwood on school hygiene for teachers. In mathematics, again, Prof. M. J. M. Hill will lecture on the theory of proportion, and Dr. T. P. Nunn on the teaching of the calculus and on the arithmetic of citizenship and finance. An interesting development in connection with the classes for next session is that whereby members of the staff of the L.C.C. training colleges are giving courses of lectures and demonstrations in various centres in London. This plan should assist to coordinate the theory of the lecture-room and the actual practice of the class-room.

SOCIETIES AND ACADEMIES.

LONDON.

Geological Society, June 19.—Dr. Aubrey Strahan, F.R.S., president, in the chair.—R. D. **Vernon**: The geology and palæontology of the Warwickshire coalfield. The main objects are to determine the true age of the so-called "Permian" rocks of Warwickshire, and their stratigraphical relationship to the underlying Carboniferous rocks and to the overlying deposits of Triassic age. The Carboniferous rocks are subdivided into groups, and the age of the subdivisions is determined from a study of the fossil flora. On stratigraphical and palæontological evidence it is shown that a large area of rocks previously mapped as Permian is really Carboniferous. The Carboniferous rocks are subdivided into groups which, on palæobotanical evidence, are proved to belong to the following three horizons of the Westphalian Series: the Upper Coal Measures, the Transition Measures, and the Middle Coal Measures; the Lower Coal Measures are found to be absent. The fossil flora is described in detail, and a brief account is given of the freshwater and marine faunas of the Middle Coal Measures. The Carboniferous rocks of Warwickshire are correlated with those of the other coalfields of the Midland province, and it can thus be demonstrated that there is a marked southerly attenuation and overlap of each of the subdivisions of the Carboniferous system.—W. H. **Hardaker**: The discovery of a fossil-bearing horizon in the Permian rocks of Hamstead, near Birmingham. Some quarries in the Permian rocks in the neighbourhood of Hamstead, near Birmingham, have afforded an interesting series of fossils. These consist chiefly of the impressions of plants, and of the footprints of amphibia assignable to several species. The quarries occur in the broad band of strata which is coloured upon the Geological Survey map as Permian, and fringes the eastern side of the South Staffordshire coalfield. The group (and subgroups) in which the fossils occur are described and illustrated in detail, and show that the group as a whole belongs in its lower part to the Midland Middle Permian (or Calcareous Conglomerate and Sandstone) division of Mr. Wickham King, and in its upper part to his Upper Permian (or Breccia and Sandstone) division. Most of the plants and animal footprints discovered belong apparently to recognisable forms which have been long known to occur in the Rothliegende (or typical Lower Permian) of Germany, and they have little or no resemblance to those of the undisputed Upper Carboniferous of any known area; and the conclusion is drawn that these fossil-bearing Hamstead strata must in future be regarded as of Rothliegende or true Lower Permian age.

PARIS.

Academy of Sciences, July 16. M. A. Gautier in the chair.—Ch. **Moureu** and A. **Lepape**: Some natural gases rich in helium. Three springs at Santenay evolve gases richer in helium than those previously investigated. Of these, the "Lithium" spring produces a gas containing 10·16 per cent., by volume, corresponding to a total annual yield of 5182 litres of helium, and the "Carnot" spring a gas containing 9·97 per cent., with an annual yield of 17,845 litres. A spring at Néris (Allier), though its gases are poorer in helium, yields annually nearly 34,000 litres of this element. If the helium from the "Carnot" spring has been evolved entirely from radio-active bodies, and if it has been evolved at the rate at which it was formed, this would necessitate the presence of 91 tons of radium, or of 500,000,000 tons of pitchblende, &c. If, however, it is, so to speak, fossil helium, its presence would mean the disintegration of about 2 tons of thorianite, or of 167 tons of pitchblende.—Émile **Borel**: The indeterminate nature of analytical functions in the region of a singular essential point.—Jules **Andrade**: The measurement of friction.—A. **Guillet** and M. **Aubert**: A spark electrometer.—A. **Leduc**: The densities of some gases and vapours.—Daniel **Berthelot** and Henry **Gaudechon**: Radiations producing the photosynthesis of complex compounds, the polymerisation of certain gases, and the decomposition of acetone. Radiations from a quartz-mercury vapour lamp produce formamide from a mixture of carbon monoxide and ammonia, but sunlight does not act similarly; decomposition of the formamide can also be brought about by the radiations from the mercury lamp, and more slowly by sunlight. Cyanogen is polymerised by sunlight, and more rapidly by the lamp radiations; acetylene is polymerised by the lamp, not by sunlight. Acetone is not

affected by the solar radiations, but those from the lamp split it up rapidly into carbon monoxide and ethane. Aqueous solutions of acetone also yield acetic acid and methane.—M. **Markétos**: The anhydrous nitrates of uranyl and of zinc. These can be prepared by heating the hydrated nitrates carefully in an atmosphere of nitric acid vapour.—Pierre **Jolibois**: Grignard's reaction.—H. **Cousin** and H. **Hérissey**: The oxidation of parathymol. Dehydrodiparathymol. When parathymol is oxidised either by ferric chloride, or by air in presence of the oxydase of fungi, two molecules lose hydrogen and unite to form dehydro-parathymol, of which the properties are described.—P. **Lemoult**: Diphenylethylene derivatives; preparation of two cyclohexylidene bases. The bases in question are produced by the action of the compound of cyclohexyl bromide and magnesium on Michler's ketone, and on its tetraethyl homologue.—Georges **Abt**: Salt stains on skins and hides. These stains, which detract seriously from the value of the materials, are caused by the presence of calcium sulphate in the salt liquors used in pickling.—A. **Duffour**: Isomorphism of the irido- and rhodiochlorides of the alkali metals. A crystallographic comparison of the potassium, rubidium, cæsium, ammonium, and dimethylammonium salts derived from H_3IrCl_6 and H_3RhCl_6.—Louis **Matruchot**: The culture of *Lepiota procera*.—Romuald **Minkiewicz**: The nature of the chromotropism of the Nemertea. Red light exerts a specific action on these animals.—M. **Wedensky**: Prolonged excitation of sensory nerves and its effect on the central nervous system.—Robert **Lévy**: The mechanism of the hæmolysis caused by arachnolysin. Arachnolysin is probably not a direct hæmolytic toxin, but rather a complex system, like many other venoms.—Henry **Cardot** and Henri **Laugier**: The mechanism of the inversion of the polar law of Pflüger.—L. **Camus**: Passive immunisation.—Charles **Nicolle**, L. **Blaisot**, and A. **Cuénod**: The susceptibility of the Magot (*Macacus inuus*) to trachoma. Filtrability of the virus. Infective power of the tears. The chimpanzee is readily infected with trachoma, the course of the disease being very similar to that in man. Owing, however, to the rarity of these animals, the authors investigated several of the lower apes with regard to their susceptibility to the disease, and found that *Macacus inuus* was easily infected. The virus was still potent after filtration. Infection may be conveyed by the tears.—Pierre **Delbet** and Pierre **Cartier**: Hæmarthrosis of the knee. The bacillus of tubercle was found to be present in many of the cases investigated.—E. **Kayser**: The influence of uranium salts on alcoholic ferments. Very small amounts of these salts act as stimulants to the ferments, larger quantities as poisons. Yeast slowly acquires a tolerance to the action of uranium.—Gabriel **Bertrand** and H. **Agulhon**: The presence of boron as a normal constituent of animal tissues. In exceedingly small amounts, boron was found to be present in most of the tissues of the five animals examined—guinea-pig, rabbit, sheep, cow, and horse. The dried muscles of the rabbit contained about one part in two million.

BOOKS RECEIVED.

Henri Poincaré. Biographie, Bibliographie Analytique des Écrits. By E. Lebon. Seconde Édition. Pp. 112. (Paris: Gauthier-Villars.) 7 francs.

La Pêche au Bord de la Mer. By L. Jouenne and J. A. Perreau. Pp. 311. (Paris: J. B. Baillière et Fils.) 4 francs.

The Fire Resistance of Doors and Shutters: being Tabulated Results of Fire Tests Conducted by the Committee. Compiled by E. O. Sachs and E. Marsland. (Journal of the British Fire Prevention Committee. No. vii., 1912.) Pp. 11+2 plates+tables. (London: British Fire Prevention Committee.) 42*s*. net.

Outdoor Philosophy: the Meditations of a Naturalist. By S. D. Kirkham. Pp. xii+214. (New York and London: G. P. Putnam's Sons.) 5*s*. net.

A Handbook on the Gas Engine. By H. Haeder. Translated by W. M. Huskisson. Pp. xii+317. (London: C. Lockwood and Son.) 18*s*. net.

The Extra Pharmacopœia of Martindale and Westcott. Fifteenth Edition. Revised by Dr. W. A. Martindale and W. W. Westcott. Vol i., pp. xxxi+1114. Vol. ii., pp. viii+370. (London: H. K. Lewis.) Vol. i., 14*s*. net; vol. ii., 7*s*. net.

A Guide for the Study of Animals. By W. Whitney, F. C. Lucas, H. B. Shinn, and M. E. Smallwood. Pp. ix+197. (Boston, New York, Chicago, and London: D. C. Heath and Co.) 2*s*.

Their Winged Destiny: being a Tale of Two Planets. By D. W. Horner. Pp. vi+240. (London: Simpkin and Co., Ltd.) 2*s*. net.

Das Relativitätsprinzip: eine Einführung in die Theorie. By A. Brill. Pp. iv+29. (Leipzig and Berlin: B. G. Teubner.) 1.20 marks.

The Story of our Trees, in Twenty-four Lessons. By M. M. Gregson. Pp. xii+160. (Cambridge University Press.) 2*s*. 6*d*.

The Record of the Royal Society of London. Third Edition. Pp. viii+483. (London: H. Frowde.) 15*s*. net.

Lehrbuch der Physik. By Prof. E. Riecke. Fünfte Auflage. Erster Band. Pp. xvi+600. Zweiter Band. Pp. xii+775. (Leipzig: Veit and Co.) 26 marks.

Die Assimilationstätigkeit bei Schmetterlings-Puppen. By Prof. G. von Linden. Pp. 164+iii Taf. (Leipzig: Veit and Co.) 4.50 marks.

Physik in graphischen Darstellungen. By F. Auerbach. Pp. x+213 plates+28. (Leipzig and Berlin: B. G. Teubner.) 9 marks.

CONTENTS.

	PAGE
Mechanical and Chemical Engineering	549
Kainozoic Stratigraphy. By J. W. G.	551
Analytical Chemistry	552
Our Bookshelf	553
Letters to the Editor:—	
Some Optical Experiments.—Herbert S. Ryland	554
Photosynthesis and Stomatal Aperture.—W. Lawrence Balls	555
Curie's Constant in the Ferromagnetic State.—J. R. Ashworth	555
Elliptic Functions.—C. T. Whitmell	555
The Pygmies of New Guinea. (*Illustrated.*) By C. G. S.	556
The First International Eugenics Congress. By E. H. J. S.	558
Notes	561
Our Astronomical Column:—	
Astronomical Occurrences for August	566
Observations of New Stars	566
The Spectroscopic Determination of Aqueous Vapour in the Atmosphere	566
Personal Errors in Transit Observations	566
The British Medical Association	566
Physiography of the Prairies and North-Eastern Australia. By R. L.	567
Some English Publications on Agricultural Science	568
Grants for Scientific Purposes from the Development Fund	568
The State Universities of France	571
University and Educational Intelligence	572
Societies and Academies	573
Books Received	574