THURSDAY, MAY 29, 1919.

NATURAL ORGANIC COLOURING MATTERS.

The Natural Organic Colouring Matters. By Prof. A. G. Perkin and Dr. A. E. Everest. (Monographs on Industrial Chemistry.) Pp. xxii+655. (London: Longmans, Green, and Co., 1918.) Price 28*s.* net.

THIS comprehensive treatise is the first English monograph to deal exhaustively with the fascinating but complex chemistry of the natural organic colouring matters. The historical aspect of the subject-matter and the scheme of classification are unfolded in the introduction, after which eighteen groups of natural dyes are described. The first chapter deals with the anthraquinone group, containing alizarin, the colour principle of madder root, which shares with indigo of the nitrogenous indole group the distinction of being one of the dyes of an antiquity so remote that it precedes the dawn of history. Although the importance of alizarin and its synthetic derivatives has overshadowed that of its other naturally occurring congeners, yet it should not be overlooked that the anthraquinone group contains also cochineal, a colour principle originally obtained from Mexico, and utilised in the ancient American civilisations long before it became known to Europeans. Lac and kermes, the Asiatic counterparts of cochineal, also contain colour principles belonging to the anthraquinone group. It is remarkable that naphthalene, which figures so largely in the production of synthetic dyes, is represented among natural colouring matters only by the small naphthoquinone group.

The majority of the natural yellow colouring matters are derived from xanthone or flavone, and much of our knowledge of these two groups is derived from the researches of Prof. A. G. Perkin, one of the authors, who has devoted himself for many years to the study of this intricate branch of organic chemistry. The flavone and flavanone groups have also received the attention of a band of Irish workers under the guidance and inspiration of Prof. Hugh Ryan.

The researches of Willstätter, carried out in the generously endowed Kaiser Wilhelm Institute at Dahlem, partly with the assistance of British and American collaborators, including Dr. Everest, the joint author of this treatise, have led to the elucidation of the chemical nature of many colouring matters of the γ-pyran group. The anthocyan pigments, present as glucosides in many flowers and coloured fruits, form a comparatively large class of natural colouring matters derived from pelargonidin, cyanidin, and delphinidin. These fundamental anthocyanidins are in all probability produced from the yellow flavonol sap pigments by a process of acid reduction. They are oxonium compounds, which are generally isolated in the form of their crystalline chlorides. These researches, which have demonstrated the chemical nature of the varied hues of the cornflower, salvia, pansy, aster, chrysanthemum, peony, hollyhock, and many other flowers, and of the colours of the ripe cranberry, bilberry, and black grape, are of the utmost scientific importance in extending our knowledge of the products of plant life.

The dihydropyrane group includes hæmatein, the colour principle of logwood, the most important natural dyewood, which is still extensively employed by dyers.

The chapter on the colouring matters of unknown constitution shows that there is still ample scope for patient study and systematic research among the natural dyes. There is a special reason now why these laudable efforts should be supported to the fullest extent and with Governmental assistance. Many of the plants yielding unclassified dyes have a tropical or subtropical habitat, and the fortunes of war are bringing these localities more even than formerly under the control of the Allied nations, to the exclusion of the Teutonic States. It behoves the statesmen of the victorious Allies to encourage to the fullest extent the work of those trained observers who are prepared to devote themselves to the study of these interesting and possibly utilitarian problems. The treatise under review, which presents a complete epitome of the researches carried out on natural dyes, will prove to be not only an indispensable work of reference, but also a source of inspiration to any scientific worker wishing to extend the boundaries of our present knowledge of these colouring matters. G. T. M.

EDUCATION AND INDUSTRY.

Can We Compete? Germany's Assets in Finance, Trade, Education, Consular Training, etc., and a Proposed British War-cost Reduction Programme. By G. E. Mappin. Pp. 159+chart. (London: Skeffington and Son, Ltd., n.d.) Price 4*s.* 6*d.* net.

MR. MAPPIN'S book consists virtually of a number of essays on a wide variety of subjects, which include technical universities, town planning, land registration, the training of women to become self-supporting, the reclamation of peat bogs, etc.

From his observations as a student in Germany, Mr. Mappin describes how the different problems are there dealt with, and, where a comparison is possible with our methods, suggests the lines on which our industry, commerce, and education should be reorganised. The book lacks co-ordination between its various sections, and is written in a sketchy and unconvincing way. In making out a case in favour of certain proposals on German lines, the author over-emphasises the prevailing state of affairs in this country. Further, he does not appear to be fully familiar with many of the conditions he seeks to reform, advancement in some respects having proceeded far beyond his proposals.

In common with many would-be reformers, Mr.

Mappin appears to believe that there is a desperate need for an alteration in the conduct of affairs in this country, simply because similar affairs are undertaken on different lines elsewhere, and apparently he does not recognise that the success of national plans depends principally on the character, customs, and environment of the people, and that on this account what is successful in one country may be a failure in another.

Dealing with minor aspects of the book, many readers who have had opportunities of considering the matter will not agree with the author that British universities and technical colleges are so lacking as he maintains in their ability to display clearly the kind of courses that they provide. While many will agree that our public schools need much in the way of reform, they will scarcely support the contention that a boy goes to such a school *merely to get information.*

The author urges the claims of works schools, but is apparently unaware of the fact that there are numbers of well-established works schools in this country—some of very long standing. His suggestion that such schools should be supported financially by the premiums obtained from gentlemen apprentices is deplorable. Fortunately, the premium system in connection with manufacturing firms is fast dying out, and in this respect we have little to learn from Germany.

In reading the chapter relating to co-operation in works, one wonders whether the author is aware of the Whitley report, or of the widespread adoption of works committees.

In an appendix on technical universities emphasis is laid on the importance of practical work in co-ordination with the university training, and it is pointed out that in German universities one year of practical training is required before a degree is conferred. Apparently, Mr. Mappin is not aware that almost everyone in this country who has made a study of engineering training, and particularly the university authorities, are fully agreed that not one year, but at least two or even three years of practical training are necessary in addition to the university course, and that this practice is the prevailing one in this country for engineering students.

It is manifestly impossible to deal with the entire reform of industry, commerce, and education in this country in a volume of 159 pages, and the best that can be expected is the creation of a consciousness for a need for reform. This the author accomplishes to a considerable extent, but, to be convincing, the English conditions require much more thorough and accurate treatment than is accorded to them.

Throughout the book the author seems to consider only what he believes to be the deficiencies of this country, and fails to take into account our assets. The war was won largely because of the character of the people—their individuality, adaptability, and inherent industrial capacity. These factors will be predominant in the competitive times of peace.

ESSEX WATER SUPPLY.

The Water Supply of Essex from Underground Sources. By W. Whitaker and Dr. J. C. Thresh; the Rainfall by Dr. H. R. Mill. (Memoirs of the Geological Survey. England and Wales. Sir Aubrey Strahan, director.) Pp. iv+510+iv maps. (London: His Majesty's Stationery Office, 1916.) Price 15*s.*

THE issue of this volume, actually printed in 1916, was delayed by the War Office until November of last year. It is an important addition to the series of county water-supply memoirs, of which a dozen have already been published. In consequence of the wide extent of the county, and the many interesting problems connected with its water resources, this memoir exceeds in size any previous volume of the series. Along with the latest information concerning water supply, it contains many extracts from old records, showing the conditions in past times, and furnishing an instructive illustration of the progress that has been made in public health.

The separate sections are contributed by our leading authorities in these special subjects. Thus the geology and water resources have been treated in great detail by Mr. W. Whitaker, who during his official connection with the Survey obtained an intimate knowledge of the geology of the county, and since his retirement has devoted particular attention to its sources of water. Dr. J. C. Thresh, for many years the medical officer of health for Essex, through a prolonged study of the chemistry of the local waters, has contributed a remarkably comprehensive account of the subject, that is of the greatest general interest. Again, as in previous memoirs, the rainfall of the county has been dealt with by Dr. H. R. Mill, the director of the British Rainfall Organisation.

With the exception of the metropolitan area, Essex is dependent for its water supply on wells, with some slight assistance from springs. The chalk is the chief source, though in many parts, where reached only at great depths, it fails to yield large supplies. This is attributed to the relatively narrow and tight fissures, which probably exist beneath a considerable thickness of overlying beds. Second only to the chalk as water-bearing strata follow the sands, clays, and gravel beds of the Lower London Tertiaries, which in Essex are of more importance from a water-supply aspect than in any other county. Finally, the Boulder Clay, London Clay, drift gravels, and sands afford small local supplies of water at a relatively low cost, although their quality is not always above reproach.

One of the most interesting sections of this volume is that in which the chemistry of the chalk waters is discussed by Dr. Thresh. The waters obtained from the chalk, where deeply covered by Tertiary beds, are soft, and contain sodium carbonate, with a considerable amount of salt, in contrast to the normal hard chalk-water occurring at, or near, the chalk outcrop itself. Dr. Thresh shows by experiment that, by mixing dif-

ferent proportions of chalk water and sea water, and by passing the mixtures through Thanet Sand, the resulting filtrates can be made almost identical with the varying deep-well waters of Essex. It was already known that calcareous waters become softened after passing through certain silicates of alumina with potash, and Dr. Thresh advances the theory that a similar action occurs in the chalk waters of Essex, where they are in contact with, or have passed through, the Thanet Sand formation, the presence of sodium chloride being due to a slight influx of tidal or sea water.

Nearly four-fifths of this volume is devoted to the geological sections, water records, and water analyses of many hundreds of wells in the county; and, following a model index, four folding maps illustrate the distribution in Essex of the alkaline and saline chalk-wells, the chalk water-levels, and the isohyetal distribution of rainfall.

The amount of work involved in the preparation of this memoir must have been very great, but the utility of a treatise of this kind is in direct proportion to the amount of information provided. All those, therefore, who make, or are likely to make, direct use of this series of memoirs cannot but be grateful to the Geological Survey and the authors for the valuable and comprehensive data incorporated within the present volume.

H. L.

OUR BOOKSHELF.

Modern Chemistry and Chemical Industry of Starch and Cellulose. (With Reference to India.) By Prof. T. C. Chaudhuri. Pp. viii + 156. (Calcutta: Butterworth and Co. (India), Ltd.; London: Butterworth and Co., 1918.) Price Rs.3.12.

IN India, as in other British countries, the war has been the means of directing attention to missed opportunities, to unexplored and unexploited natural resources, and to new possibilities of industrial development.

Prof. Chaudhuri is apparently so much impressed with these matters that he has been unable to confine his attention to the subjects on which he set out to write. He provides his readers with a map of India "showing chief vegetable produces [*sic*]," throws in "some thoughts on industrial problem in India," and finally devotes a whole chapter to a review of recent developments in chemical industry in India. In spite of the inclusion of this interesting but irrelevant matter, he contrives to give a useful account of the chemistry of cellulose and starch, and of the great industries which depend on these important raw materials. The author has unfortunately succumbed all too frequently to the temptation to overload his description with unnecessary details, and has thereby been led in some cases into making statements which, to say the least, require qualification. He says, for example, that "there are various kinds of arrowroots—Indian, Brazilian, English, etc. They are all made at the present day from starch, which is obtained from different sources"; and again: "Arrowroot derives its name from the fact that the juice (cassava-root juice) was used by the West Indians as a poison for the tips of their arrows." There was no need to refer to a comparatively unimportant variety of starch such as arrowroot in a small book of this kind, and the information given is misleading, if not actually inaccurate. T. A. H.

The A B C of Aviation. By Capt. Victor W. Pagé. Pp. 274. (New York: The Norman W. Henley Publishing Co.; London: Crosby Lockwood and Son, 1918.) Price 12*s.* 6*d.* net.

"THE A B C of Aviation" justifies its title in that it is a very elementary treatment of the subject of aviation. The writer was chief engineer officer at the Signal Corps Aviation School, Mineola, U.S.A., and a good idea of the contents of the book is obtained by imagining the author to have set down in print what he observed of the aeroplanes and aeroplane parts which have passed through the stores of an aviation school. It is essentially superficial both as to theory and construction, and cannot be recommended as a serious introduction to the study of aerostatics or aerodynamics, or even for constructional design. The diagrams of the flow of air round an aeroplane wing are graphic, but very unreal; they show a large region of stagnant air over half the upper surface, which has no counterpart in the real flow of air over a wing.

The work is profusely illustrated with line drawings dealing chiefly with aviation, but with cursory reference to the balloon and airship, and the most useful feature of the book is its wealth of illustrative detail. Skeleton drawings are given of wings, fuselage, ailerons, elevators, and rudders. Each part of the aeroplane has its separate figure with a simple, clear statement of its name. There are full facilities for finding the disposition of the control surfaces, wires, etc., and the connections of the pilot's control column and rudder bar to the elevators, ailerons, and rudder. The engine controls are not dealt with in such a complete and simple manner, probably because the author has dealt with that branch of aviation in an earlier work.

Organic Chemistry, or Chemistry of the Carbon Compounds. By Victor von Richter. Vol. i., "Chemistry of the Aliphatic Series." Newly translated and revised from the German edition (after Prof. E. F. Smith's third American edition) by Dr. P. E. Spielmann. Second (revised) edition. Pp. xvi + 719. (London: Kegan Paul, Trench, Trübner, and Co., Ltd., 1919.) Price 21*s.* net.

THE first edition of Dr. Spielmann's translation was reviewed in our issue of March 16, 1916 (vol. xcvii., p. 54), and it is sufficient to say that the opportunity offered by the need for a second edition has been taken to correct certain misprints in formulæ and numbers which previously had escaped notice.

LETTERS TO THE EDITOR.

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. *No notice is taken of anonymous communications.]*

The Canadian Government and the Proposed Hunting of Caribou with Aeroplanes.

In several English periodicals that have reached me I find reference to the correspondence in the *Times* concerning a suggestion emanating from Toronto that our barren-ground caribou might be driven in large numbers into corrals by means of aeroplanes and slaughtered in order to increase the meat supply. Such a suggestion has naturally created some alarm in the minds of many naturalists, sportsmen, and others in England, and hopes have been expressed that no such scheme would be permitted.

It is with the view of assuring zoologists in England and all those who are interested in the conservation of wild life that they need have no fear that such a scheme would be sanctioned by the Canadian Government, if it follows, as is usual, the recommendations of its advisers, that I am taking the opportunity of presenting a few of the facts concerning the subject.

On the recommendation of the Commission of Conservation and the Government's Advisory Board on Wild Life Protection, an inter-departmental committee, the North-West Game Act was completely revised two years ago. This Act governs the protection of game, fur-bearing animals, and wild life generally throughout the North-West Territories, which region includes all the portion of Canada north of latitude 60° (excluding Yukon Territory, which is governed, however, by an ordinance generally similar in its provisions, and Quebec). The main reasons for this revision were to give greater protection to the bison, musk-ox, caribou, and fur-bearing animals.

No person, other than a native, may hunt or kill caribou or other game without a licence from the Minister of the Interior. Such control is exercised for the express purpose of preventing harmful or excessive killing.

The idea of hunting caribou with aeroplanes is not new. Similar proposals have been made by different people at various times since the development of the aeroplane and its use in the war; some enthusiasts have added Maxim-guns to their means of offence. But to all such suggestions a deaf ear has been turned. During the war repeated efforts were made to secure a general relaxation of the game laws to permit the killing of game for food owing to the high price of meat. The Canadian Government resolutely opposed any such action, and a similar firm stand was taken by the Provincial Governments. It was realised that any such relaxation of the laws and the resulting excessive killing would mean the destruction almost to the point of extermination of many species of our game animals. The utilisation under Government control of the enormous herds of barren-ground caribou as a means of supplementing the domestic meat supply was very carefully considered by the Advisory Board on Wild Life Protection, but it was decided that the existing means of transportation and storage rendered any scheme of that nature impracticable at the present time. There is no doubt that with adequate protection it will be possible in the future to utilise the caribou, and, we hope, the musk-ox, which are the grazing animals most suited to that vast territory. But at the present time a policy of careful protection is being carried on by the Canadian Government.

All who are interested in the conservation of wild life may rest assured that the Canadian Government is carrying on a vigorous policy in this matter. In February last the first national conference on wild-life protection was held in Ottawa, and attended by officials and representatives from all the provinces of the Dominion. I am now preparing a report on the wild life of Canada and its conservation, which will probably be issued by the Commission of Conservation during the year. This volume will indicate the extent to which those responsible for the conservation of our Canadian wild life are fulfilling their responsibilities to posterity. Canadians are realising that Canada is the last stronghold for the greater portion of the big-game animals of North America, and are taking the necessary measures to ensure their adequate protection before it is too late. The rescue of the bison from the border-line of extermination will for ever stand as a monument to the foresight of the Canadian Government.

C. Gordon Hewitt.
Department of Agriculture, Ottawa, Canada,
May 2.

X-Rays and British Industry.

The remarks made by Major G. W. C. Kaye in his article upon "X-Rays and British Industry" (Nature, May 8) reflect so gravely upon British manufacturers that I must ask for the courtesy of a little space in order to comment on them.

Major Kaye apparently takes the view that British manufacturers, in the first place, persist in recommending induction coils rather than the more up-to-date transformers or interrupterless machines; and, secondly, do not put really intelligent design and construction even into the manufacture of the coils.

It is quite true that the invention of the interrupterless machine was due originally to an American, namely, Mr. H. Clyde Snook, but my firm placed machines of this type on the market before, I think, any American firm had produced them, and can certainly claim to be the pioneers in Europe of modern X-ray apparatus.

The difficulty in this country has lain not so much with the manufacturer as with the conservatism of medical men, the majority of whom have refused for years even to consider a closed-circuit transformer as compared with an induction coil, and, to a certain extent, hold the same opinion even to the present day.

Even now, although we are selling interrupterless machines almost faster than we can make them, it is unfortunately the case that the bulk of our output has to be sold abroad, and that there is still, comparatively speaking, little demand for them in this country, the medical public being still apparently content with putting in apparatus which would be laughed at in almost any other country in the world.

I should also like to say that, although I regard the induction coil as obsolete for ordinary radiography, it does still possess certain advantages for other work, notably therapeutic treatment, and I cannot agree with Major Kaye in his statement that the induction coil of to-day differs but little from its predecessor of Spottiswoode's day.

My firm bought the business of the late Mr. Alfred Apps, and therefore I am in a position to contrast the methods of Mr. Apps (rightly referred to in his day as the "prince of coil-makers") with the methods of the present day, and I can assure Major Kaye that progress has been a little more than he thinks, and that there have been rather more intelligent design and electrical knowledge applied to the instrument than he quite appreciates.

R. S. Wright
(Newton and Wright, Ltd.).
72 Wigmore Street, W.1.

MESSRS. NEWTON AND WRIGHT deserve great credit for their pertinacity in endeavouring to convince the British medical world of the particular merits of the Snook transformer. There is little doubt that, apart from gratifying the conservatism of a considerable section of their customers, most British coil manufacturers will presently be found concentrating their efforts on some type of interrupterless transformer.

The induction coil is no longer the best equipment for the X-ray operator. It is essentially inefficient, and, in addition, is often badly served by the (mercury) break. It has been pointed out to me that I made no mention in my article of Prof. Taylor Jones's admirable work on the induction coil. This was far from my intention. My concern would rather be with the extent to which his published results have affected the designs of the British coil manufacturer. Dr. N. R. Campbell recounts further interesting work on the subject in recent issues of the *Philosophical Magazine*.

The future does not lie with the induction coil, but rather with the closed-circuit A.C. transformer and some variety of hot-cathode valve (somewhat the same as in wireless telegraphy). This arrangement requires neither interrupter nor commutator, and the resulting simplicity will undoubtedly appeal to the medical man. Unless British manufacturers "get busy" on some such lines, the American manufacturer will have it all his own way in the future, certainly for overseas trade.

An effective association of British manufacturers might result in this country taking the lead in X-ray matters instead of developing American inventions.

G. W. C. KAYE.

Wasps.

A MODERATELY sized underground nest of the common wasp (*Vespa vulgaris*) examined by me on July 27, 1915, in Selkirkshire, was 8 in. in diameter, and contained an adult population of 417 workers and the queen. In addition, the six cell-flats of the nest contained 1159 eggs, 1216 larvæ, and 1076 pupæ, all of the first brood; 288 eggs, 248 larvæ, and 144 pupæ of the second brood; and 42 eggs, 30 larvæ, and 14 pupæ of the third brood. The actual living total at the time of examination, including eggs, larvæ, pupæ, and adults, was therefore 4635. In addition, there had apparently hatched from the cells then occupied by second and third broods 852 individuals, of which only 417 were accounted for when the nest was exterminated; the surplus brings the total to more than 5000. This was a nest which, when it was destroyed, had completed only the least active half of the wasp season.

A full account of the distribution of the different stages within the nest, and the deductions drawn therefrom as to the rates of egg-laying, cell-building, hatching, and mortality, appeared in the *Scottish Naturalist* for November, 1915.

In the same paper will be found particulars of the inmates of two other nests of the same species: one examined by Mr. A. Macdonald in September, 1915, in Kincardineshire, contained 1197 adults, 652 larvæ, and 680 pupæ, while the remainder of 5321 cells either contained eggs or were empty; the other, examined in October, 1912, by Mr. W. Evans in Midlothian, was found to contain 11,560 cells, and was estimated to have produced no fewer than 25,000 wasps in the course of the season.

JAMES RITCHIE.

Edinburgh, May 12.

DURING the year 1909 I destroyed 113 wasp-nests, also 87 in 1911, carefully took out the combs unbroken, and counted all the wasps that I could find (all wasps previously able to fly). They were mostly *Vespa vulgaris*, *V. germanica*, and a very few *V. rufa* and *V. sylvestris*. During 1910 I could find only one nest of *V. rufa*. Subjoined are a few records.

Wasp Records.

1909				1 ♀ at least in all nests.
July 21	6 combs,	547	♀♀	No large cells in comb.
,, 23	9 ,,	1475	,,	,, ,,
,, 24	3 ,,	46	,,	44 ♀♀, 67 ♂♂. *V. rufa*.
,, 25	5 ,,	396	,,	
,, 26	7 ,,	1000	,,	
,, 26	4 ,,	389	,,	106 ♂♂, 29 ♀♀.
,, 29	6 ,,	472	,,	*Vespa sylvestris*.
,, 29	6 ,,	600	,,	
,, 30	9 ,,	2509	,,	
,, 31	9 ,,	2344	,,	One large-celled comb.
Aug. 1	9 ,,	2240	,,	No ,, ,,
,, 3	9 ,,	2560	,,	
,, 5	9 ,,	2413	,,	Two ,, ,, *V. germanica*.
,, 6	8 ,,	2557	,,	One ,, ,,
,, 8	10 ,,	3919	,,	,, ,, ,,
,, 13	3 ,,	287	,,	156 ♀♀. *V. sylvestris*.
,, 15	10 ,,	4287	,,	One big-celled comb. *V. germanica*.
1911				
Aug. 9	11 ,,	3420	,,	Three ,, ,, ,,

These are a few records from about 300 acres of land here. I should conclude that 5000 ♀♀ wasps able to fly constitute a strong working nest of *V. vulgaris* or *V. germanica*, and perhaps *V. norvegica*.

RICHARD F. BURTON.

Longner Hall, Salop, May 9.

THE NATIONAL RESEARCH COUNCIL OF THE UNITED STATES.

AS the result of an executive order issued by President Wilson on May 11, 1918, the temporary arrangement inaugurated two years previously has acquired permanence as the National Research Council of the United States. The history of this organisation is instructive in showing that in time of national stress the Governmental authorities appreciate the necessity for active co-operation from scientific bodies or individuals who have in peace conditions received but little recognition or support.

During the War of the Rebellion, Abraham Lincoln caused the incorporation of the National Academy of Sciences, corresponding to the Royal Society, in order to have available, for national purposes, a body of men who were representative in their branches of science. Their duty was to investigate any problem of national importance when called upon to do so by a Government Department. The expenses of the work were to be defrayed by the State, but the academy received no compensation whatsoever. In the fifty-three years of peace which followed, the National Academy pursued its course as an ordinary scientific organisation of the highest class, giving advice to the Government from time to time when called upon to do so.

After the attack on the *Sussex* in April, 1916, the National Academy offered its services to the President for organising the research facilities of the country in order to prepare for any eventual active part of the United States in the war. This offer was accepted by the President, and the National Research Council was constituted. In July of that year the success which followed the organisation of research work by the National Academy of Sciences had already been sufficient to call forth the thanks of President Wilson.

During the succeeding eighteen months the National Research Council was thoroughly organised, and throughout this period rendered the greatest service to the nation in directing and conducting investigations connected with the prosecution of the war and with national welfare. Its activities were not confined to research alone, but a very important division occupied itself with general relations. Information was collected from foreign sources and distributed to those workers who had need of it. Large questions of reconstruction, education, and foreign relations were handled from the scientific and industrial aspects.

The technical divisions of the Council were as follows: Military; engineering; physics, mathematics, astronomy, and geophysics; chemistry and chemical technology; geology and geography; medicine and related sciences; agriculture, botany, forestry, zoology, and fisheries. Under these heads a large number of members were co-opted to deal with special subjects.

As will be seen, this very complete system enabled the National Research Council to bring under its direction practically everyone available whose capacity for research work was a national asset.

So successfully did the Council carry out the programme assigned to it that on May 11 of last year the President requested the National Academy to perpetuate the National Research Council in order that it might be available not only for war-time problems, but also for the large issues of peace.

The six paragraphs in which the President sums up the duties of the National Research Council are the clearest exposition possible of the relations of research and research workers to national efficiency, but they also point out what are the obligations of the nation towards stimulating investigation in the United States. Stress is laid on co-operative work, but it is pointed out that co-operation must be of such a type as to ensure individual initiative.

It is especially noteworthy in the President's order that collaboration of the scientific and technical branches of the Government, both military and civil, with the National Research Council is required. The nominations, however, to the Council from the Government bureaux are made by the president of the National Academy of Sciences. They are then designated by the President of the United States to take their place on the National Research Council. In this way the Government representatives are men whose scientific qualifications are vouched for by the president of the National Academy of Sciences.

Thus it is that the national direction of research work in the United States has become vested in a body of men whose conduct of research work during the war period of that country has shown that they are competent to handle the great problems which go with peace and reconstruction. The scheme is a wise one, because it calls for the closest co-operation between the Government and the research worker, but leaves the decision as to the methods of attack in the problems involved in the hands of experts.

The financing of investigations under the National Research Council was carried on with funds which aggregated 54,096*l.* for the fiscal year 1919. These were derived from the Rockefeller Foundation, the Carnegie Institution, and the President's Fund.

Two important developments have taken place since the foundation of the Council. The first is the result of the Rockefeller Foundation entrusting to the Council the sum of 100,000*l.* for expenditure within a period of five years for research in physics and chemistry in educational institutions in the United States. The primary feature of the project is the initiation of research fellowships. This will open a scientific career to a larger number of able investigators, and will meet an urgent need of the universities and industries. It is expected that fifteen to twenty fellowships will be available during the coming year.

The second development brings the Council into the closest touch with the scientific and technical societies of the United States. By a recent decision of the Council the majority of the members of a division must be representatives elected by the leading scientific societies. In the division of chemistry and chemical technology, for example, nine members are elected by the Chemical Society, one each by the Electrochemical and Ceramic Societies, and one by the Institute of Chemical Engineers. Only six members are chosen by the Council itself.

There can be no doubt that this programme, in which the direction of national research work is placed in the hands of capable men of science, in which ample opportunity is afforded younger men of originality to develop their genius, and in which the head of the State and his advisers have actively attested the vital necessity of original investigation in any scheme of national efficiency, initiates an era of scientific productiveness for the United States far greater even than the important output to which we were accustomed before the war.

C. G. L. WOLF.

WATER-POWER DEVELOPMENTS.

THE prominence which has recently been given to the latent possibilities of power in streams, at present, from an industrial point of view, running to waste, has had the effect of stimulating public and professional interest to such a degree that reports and articles on the subject are now being published in close sequence, and we are appreciably increasing our knowledge of the conditions prevailing in appropriate regions, and of the measures which are desirable for exploiting such sources of power. The Royal Swedish Waterfalls Board is losing no time in developing the mountainous supplies of Lapland. The Canadian water-power departments are equally active as regards the hydrometric survey of Canada. Our own Government has taken the

welcome step of appointing a Board of Trade Committee to investigate the water-power resources of Great Britain and Ireland. Apart from State-controlled undertakings, we have the activities of unofficial bodies like the Water-power Committee of the Conjoint Board of Scientific Societies, the second report of which lies before us. It is a useful statement of information gleaned from inquiries in various parts of the world, but principally within the British Empire, since the publication in July, 1918, of the first report, which was summarised in NATURE of September 19, 1918. It dwells particularly and justifiably on the great strides which are being made in Canada. A perusal of this report in conjunction with a paper on "Science and Industry in Canada," read by Prof. J. C. McLennan before the Royal Society of Arts on March 4, certainly leads to a feeling of admiration for the energetic manner in which the Dominion has set about compensating itself for the shortage in its available coal supply. Although Canada takes second place in the list of the world's coal-fields, yet, owing to their geographical distribution and the difficulties of production, she has at present to rely to a very considerable extent on supplies from the United States.

The total estimated water-power of Canada is stated by Prof. McLennan to aggregate 18,800,000 h.p., divided somewhat as follows:—

	Per cent.	H.P.
Ontario	31	5,800,000
Quebec	32	6,000,000
Manitoba, Saskatchewan, Alberta, and North-West Territories ...	18	3,500,000
British Columbia	16	3,000,000
Remainder of Dominion	3	500,000

According to a census completed in February last by the Dominion Water-power Branch, the total hydro-electric power actually developed is 2,305,310 h.p., which is roughly 12 per cent. of the total available. Of this quantity, rather under one-tenth is exported to the United States, despite the fact that it is badly needed by Canadian industries in order to meet their increasing requirements. We have therefore the singular situation of Canada exporting electric power, of which she has none to spare, to the United States, and importing in return coal, of which she has abundant, but unworked, supplies. This artificial and uneconomical exchange is causing no little concern in responsible circles, because, if the United States should see fit to restrict its coal exports on the perfectly reasonable ground that the whole output is required internally for the domestic manufacture of raw material, those provinces in Canada (comprising the most populous manufacturing districts) which are remote from the Dominion coal-fields would suffer most, although they are rich in hydro-electric possibilities. Under Federal law no inconsiderable portion of the energy generated may be diverted to the United States. Take the Niagara Falls, for instance. Of 388,500 h.p. generated on the Canadian side in 1917, no less than 125,000 h.p. was exported to the United States, in addition to 265,000 h.p. developed on the American side itself. It is a delicate question, calling for delicate handling; fortunately the relations between the two countries are of the friendliest description.

Some of the largest Canadian installations, either completed or in hand, are Chippewa, 300,000 h.p.; Ontario Power Co., 210,000 h.p.; Shawinigan Falls, 200,000 h.p.

Developments in Australia are not nearly so marked; indeed, there is little additional information forthcoming. The chief electrical engineer of New South Wales estimates that 300,000 h.p. is continuously available from eighteen schemes already investigated. The chief of these are the Snowy River (137,400 h.p.) and the Clarence (100,000 h.p.).

There is little also to record from South Africa. In New Zealand there is some activity over a scheme by which 130,000 h.p. will be developed at three important sites on North Island.

The report of the Committee of the Conjoint Board concludes with an admonition to the engineers of Great Britain to be ready to take their part in inevitable and impending enterprises of great magnitude in hydro-electrical engineering. The Committee utters a warning that Canadian, American, and Continental engineers will continue to exercise a controlling interest in such projects unless an effort be made to contest the situation. It also directs attention to the lack of facilities at British universities for giving the necessary specialised scientific training to those seeking to enter this field of engineering, and it points to the example set by Cornell University, U.S.A., in laying itself out to meet the demand which is bound to arise for a training of this description.

BRYSSON CUNNINGHAM.

CHEMICAL SCIENCE AND THE STATE.

IT may still be doubted whether the public generally has any clear idea as to the occupation of the chemist and the purposes to which his work is directed. Usually he is confused with the dispenser of medicine, the pharmacist, who displays in his window the familiar globes of coloured water. By way of variety and as soon as his services were urgently required for purposes connected with the war he was classed by officials in the War Office with the *labourers* in the Arsenal at Woolwich, and he was paid at the same rate. It has, however, been gradually forced on the attention of the official classes that it is only the skilled scientific chemist who is qualified to devise and manufacture explosives, dyes, and drugs of the modern type, and that he alone can provide poison gases in warfare and their antidotes.

The Institute of Chemistry, of which the offices and laboratory are situated in Russell Square, W.C., was founded in 1877, and chartered in 1885. It is a body of professional men, all of whom have passed through a course of study and training extending over several years, with additional experience gained in practice as analysts and consult-

ants. During the progress of the war the institute has been in constant communication with the War Office and other Government Departments, and has been largely instrumental in mobilising the chemists of the country both for technical service with the forces and for the production of all kinds of war material.

The authorities having at last become aware that the services and advice of the scientific chemist are indispensable in the economy of the State, it appears eminently desirable that some representative body should be recognised as the mouthpiece of the several specialised organisations which have been one after another called into existence. The Institute of Chemistry already mentioned is a professional body with aims in reference to chemistry corresponding with those of the College of Physicians in relation to medicine. But the Chemical Society is much older, having been founded in 1841, and is, in fact, the parent of all the chemical associations now existing. It is composed of about 3400 fellows, and its object is the cultivation of the science of chemistry and the publication of the results of research. The Society of Chemical Industry, founded about the year 1880, is also a very numerous and influential body, consisting of manufacturers and others engaged in the application of chemistry to practical purposes. Beside these two large societies there are the more recently founded Society of Public Analysts, the Association of Chemical Manufacturers, the Faraday Society, the Biochemical Society, the Ceramic Society, the Society of Dyers and Colourists, the Institute of Brewing, and some others less purely chemical in character.

A short time ago the Institute of Chemistry addressed representations to the Government pointing out the necessity for introducing a definite system into the conditions of appointment of chemists directly engaged in the service of the State. There are already three first-class appointments held by officials entitled respectively the "Government Chemist," "War Department Chemist," and "Admiralty Chemist," but the subordinate offices are without a recognised system as to rank, qualifications, or emoluments.

There is, however, another question of some practical importance. In the event of the Government requiring information, advice, or opinion on any chemical question, to which of the bodies mentioned should inquiry be addressed? Hitherto the Government has been much in the habit of seeking advice on all kinds of subjects from the Royal Society, and getting it for nothing. During the war the Institute of Chemistry has given valuable information and assistance. But neither of these bodies can speak for British chemistry as a whole, and, since it is obviously undesirable for any divergence of opinion to show itself in connection with matters in which the public advantage or even safety is concerned, a new body has recently been called into existence consisting of duly appointed representatives of all the chemical societies and associations. It is hoped that this Federal Council for Pure and Applied Chemistry (the establishment of which was referred to in NATURE for February 27 last, vol. cii., p. 591) will be recognised by the Government as qualified to speak for the whole of the chemists of this country; at the same time, its existence will promote the general recognition of the profession of chemistry and of its right to a position corresponding with that of the other learned professions.

NOTES.

THE eighty-seventh annual meeting of the British Association will be held in Bournemouth from Tuesday, September 9, to Saturday, September 13, under the presidency of the Hon. Sir Charles Parsons, who will deliver an address to the association (dealing with engineering and the war) at the inaugural general meeting in the Winter Gardens on September 9 at 8.30 p.m. The sectional work will begin on Tuesday morning, and the days available for sectional meetings will therefore be Tuesday, Wednesday, Thursday, and Friday, September 9, 10, 11, and 12, and, if required, Saturday morning, September 13. The following presidents of sections have been appointed by the council:—A, Mathematical and Physical Science, Prof. Andrew Gray; B, Chemistry, Prof. P. Phillips Bedson; C, Geology, Dr. J. W. Evans; D, Zoology, Dr. F. A. Dixey; E, Geography, Prof. L. W. Lyde; F, Economic Science and Statistics, Sir Hugh Bell, Bart.; G, Engineering, Prof. J. E. Petavel; H, Anthropology, Prof. Arthur Keith; I, Physiology, Prof. D. Noel Paton; K, Botany, Sir Daniel Morris; L, Educational Science, Sir Napier Shaw; and M, Agriculture, Prof. W. Somerville. Evening discourses will be delivered on Thursday, September 11, by Sir Arthur Evans on "The Palace of Minos and the Prehistoric Civilisation of Crete"; and on Friday, September 12, by Mr. Sidney G. Brown on "The Gyroscopic Compass."

A MEETING of subscribers to the Ramsay Memorial Fund will be held on Thursday, June 5, at 5 p.m., at University College, London, for the purpose of considering plans to be submitted by the executive committee with respect to the progress of the fund and to the objects to which the fund should be devoted. The total amount already given or promised amounts to 42,794*l.* 10*s.* 9*d.* This sum includes the following contributions, either in full payment or on account of the collections by the following overseas committees:—Switzerland, 817*l.* 6*s.* 9*d.*; United States of America, 626*l.* 15*s.* 10*d.*; Japan, 500*l.* 9*s.* 2*d.*; India, 397*l.* 8*s.* 4*d.*; Italy, 395*l.* 16*s.* 8*d.*; Denmark, 225*l.*; Norway, 186*l.* 6*s.* 7*d.*; Chile, 128*l.* 6*s.* 8*d.*; Holland, 68*l.* 1*s.* 7*d.*; Australia, 37*l.* 16*s.*; New Zealand, 21*l.* 3*s.* 6*d.* It also includes 5177*l.* 18*s.* 6*d.* collected by the Glasgow committee for a Glasgow fellowship. Promises, either provisional or definite, for the foundation of one, or more than one, Ramsay Memorial Fellowship have been received from the Governments of Italy, Japan, Spain, Norway, China, and Greece, and other Governments have the matter under favourable consideration.

UNDER the auspices of the French Government the Office Commercial Français en Angleterre has organised in London an exhibition of optical instruments and perfumery. The Office Commercial is a recently created department of the French Ministry of Commerce, and its object is to assist manufacturers to develop export trade. The exhibition is

being held at 153 Queen Victoria Street, and will be open until June 5. The optical exhibits include field- and opera-glasses, telescopes, kinematographs, surgical mirrors, laryngoscopes, spectacles, etc. So much advance has been made in this industry by British manufacturers during the war, and so little is known of it on the Continent, that we hope something will be done to hold in Paris and elsewhere an exhibition of optical and other manufactures in which we have achieved decided progress. Perhaps arrangements can be made to transfer to some Continental cities the main part of the British Scientific Products Exhibition to be held at the Central Hall, Westminster, during July.

IN view of the present industrial unrest and the difficult social problems with which the country will be faced during the next few years, the promotion of better relations between employers and employees demands scientific study. The National Alliance of Employers and Employed, through its organ *Unity*, is adopting the enterprising step of offering a series of prizes presented by Sir Robert Hadfield, and amounting in all to 200*l*., for the best essay on either of the following subjects:—"A Practical Scheme for the Joint Development of Industry by Capital and Labour," "The Most Effective Means for the Prevention of Unemployment," and "The Most Effective Means for the Prevention of Industrial Disputes." The committee of award will consist of the Right Hon. Fredk. Huth Jackson (chairman of the National Alliance), the Master of Balliol College, Oxford, and the Right Hon. Arthur Henderson. Essays must not exceed 3000 words in length, and must be addressed to the Editor, *Unity*, 64 Victoria Street, London, S.W.1, marked "Essay Competition." The competition closes on August 30, and the rights of publication of essays submitted are to be vested in *Unity*.

THE difficulties experienced by many university graduates in obtaining employment suitable to their education and abilities received careful consideration at a recent meeting of representatives of the universities, the Imperial College of Technology, and the Federation of British Industries, under the chairmanship of Sir Richard Vassar-Smith. The proposal to set up an organisation which might act as a "clearing-house" between the universities and the industries of the country was received so favourably that it was decided to hold a further meeting to consider the practical details of the scheme. An efficient organisation of the nature suggested should ensure that all grades of university students would have the opportunity of passing into that type of productive employment in which they would be able to use their abilities to the fullest extent. It would also make for that closer co-operation between the university and industry which is so essential for national prosperity in the years to come. The marked tendency for the university graduate to proceed overseas would undoubtedly be checked by the offer of suitable employment in this country, and the setting up of such an organisation will meet with the approval of all interested in national well-being. The carrying out of the scheme at an early date would exert a considerable influence on the maintenance of that steady flow of workers through the university to commerce and labour which is looked forward to on all sides.

A PETITION in opposition to the Dogs Protection Bill, with more than eight hundred signatures, chiefly of residents in Leeds and other cities in Yorkshire, has been collected by a few private individuals in ten days, and has been forwarded to the Home Secretary. It was pointed out that, in the opinion of the petitioners, the Bill would do harm by interfering with the progress of medical research. The list of signatures included the heads of many of the departments of science, technology, and medicine in the University of Leeds, as well as many important members of the administrative staff of the University. There were also names of many members of the infirmary staff, important civic persons, and representatives of the clerical, legal, dental, nursing, and other professions. The Bill was amended in the House of Commons during the report stage on May 23 by the insertion of a provision, moved on behalf of the Government, permitting experiments where the object in view would be frustrated unless it was performed on a dog. The amendment was carried by a majority of 78, and the Bill now awaits a third reading.

THE Society for the Prevention of Hydrophobia (founded in 1886) is being reorganised for the purpose of influencing public opinion and urging the Government to adopt universal muzzling for eight months, accompanied by six months' quarantine on all imported dogs, which past experience has shown to be the quickest, safest, and only means of completely eradicating rabies and hydrophobia. It is the stray, wandering, and uncared-for dogs, which infest every town and village, that are the most likely to be bitten by a rabid dog escaped from an infected area and to spread the disease farther afield. Universal muzzling would lead to the seizing and elimination of all stray dogs before a rabid dog arrived in the district. To wait until a rabid dog *has arrived* in a district and infected one or more of these strays is a fatal mistake. A forty-mile radius is all very well for cattle disease and swine fever, but not for rabies. Amongst those who have lately joined the committee are Sir John McFadyean, principal of the Royal Veterinary College; Dr. C. J. Martin, director of the Lister Institute; Mr. Stephen Paget, and Major Penberthy, president of the Royal College of Veterinary Surgeons (1897). Mr. J. Sidney Turner has been elected chairman. Vice-presidents will include Surg.-Gen. Sir David Bruce, Sir J. Rose Bradford, the Earl of Chesterfield, Sir Watson Cheyne, Bart., Earl Curzon of Kedleston, Major David Davies, the Duchess of Newcastle, Lord Bledisloe, Mr. Leslie Scott, K.C., and the Hon. A. H. Holland-Hibbert.

AN outline of the progress in practical radiotelegraphy during the past four years was given last week by Mr. Godfrey Isaacs in an address before the members of the Aldwych Club. The range of maritime communication, which before the war averaged 200 miles by day and 500 miles at night, had been quadrupled. "Jamming," apparently, has been eliminated, and Mr. Isaacs said ships would in future be able to telephone and telegraph either to ships at sea or to the coast without any possibility of interference. The wireless "direction-finder" would enable the pilot of an aeroplane or airship to ascertain approximately where he was at any time. A further development had produced a new transmitter, which would project into the air a wide, divergent beam, something like a searchlight without the light, which would extend over any area required, or, if it was desired, a concentrated beam over some small place, and these beams would convey to the men in the sky automatically the name of the place they were passing over. Similarly, these beams could be equipped to lightships or buoys in fixed and defined positions, so that even when passing over the sea an airman would know exactly where he was. With regard to land communications, very little was done before the war, particularly in well-populated countries, such as those in Europe, in connection with wireless telegraphy, for the reason that if they had

had a number of wireless telegraphy stations in close proximity, interference with each other would have made an efficient service quite impossible. That was a thing of the past. There was no reason why there should not be wireless telegraph and wireless telephone services between all the principal centres throughout this country. London could talk to Manchester or Edinburgh or Dublin without any possible danger of interfering with any other station, and those messages could not be overheard by any other station. In telegraphing and telephoning, the same thing exactly applied. Mr. Isaacs regarded that as an epoch-making invention. He thought a very great service would be done if wireless telegraph and wireless telephone services were constructed as auxiliaries to land-lines. Wireless to-day could do 150 words per minute simplex and 300 words a minute duplex. It would require but a very small mechanical improvement to double and quadruple that number of words transmitted by wireless. Mr. Isaacs was quite satisfied that, so soon as wireless traffic needed the greater speed of transmission, mechanical improvement would be introduced, and they would get something in the neighbourhood of 600 words per minute.

MR. VAUGHAN NASH and Sir T. H. Middleton have been appointed Commissioners under the Development and Road Improvement Funds Acts.

SIR ALBERT STANLEY has, on account of ill-health, tendered his resignation as President of the Board of Trade, and Sir Auckland Geddes has been appointed as his successor.

THE appointment of the Ray Lankester investigator having been suspended during the war, the following have now been appointed, beginning or expected to begin work at the Plymouth Marine Biological Laboratory on the dates named:—Mr. L. R. Crawshay, March 1 (Porifera); Mr. H. M. Fox, June 21 (marine insects); Mrs. Redman King, July 3 (Echinus); and Prof. W. Garstang (Ascidians).

THE Ipswich Field Club has lately investigated two of the tumuli on Martlesham Heath, Suffolk, and proved them to belong to the Bronze age. Mr. J. Reid Moir, who superintended the work, gave an account of the results to a meeting held on the spot on May 17. He showed the remains of a very thin bronze bowl, which seemed to be partly covered with a material like linen in a good state of preservation. It contained incinerated human bones, part of a bone comb, a bead, and other fragments apparently of ornament. Traces of hearths were distinct in the larger mound examined.

THE Board of Agriculture and the Road Board have appointed a joint sub-committee to arrange for experiments to be carried out to ascertain whether there is any foundation for the allegation that tar-treated roads are a source of danger to fisheries; if so, to what extent; and what measures can be taken to minimise or obviate the possible danger. The sub-committee consists of:—Dr. Jee, Chemical Adviser to the Board of Agriculture; Dr. Hammond Smith, Scientific Adviser to the Salmon and Trout Association; Mr. W. J. A. Butterfield, Consulting Analytical Chemist to the Road Board; and Mr. W. J. Taylor, County Surveyor of Hampshire.

IN a recent issue of the *Fishing Gazette* (April 5) Mr. W. J. A. Butterfield discusses the question of the poisoning of fish by road-washings. As regards tarred roads, it is noted that the constituents of coal-tar most directly injurious to fish are the phenols. These may be present to the extent of 3 per cent. in tar for road use, though generally the proportion is much less. Water dissolves out a little of the phenols, and such contaminated water draining into rivers may, no doubt, under particular conditions, be deleterious to fish, although experiments have shown that, so long as the proportion of phenol is not more than 0·25 in 100,000, the water is perfectly safe. Considerable pollution is possible where the river runs through a valley and is crossed by the road, so that drainage from the inclines on either side flows into the river. The periods when a tarred road is likely to be most dangerous to fish life are (1) when the tarring is quite fresh and followed by heavy rainfall, which washes away some of the tar before it has set; and (2) when the coating of tar is broken up by wear-and-tear, so that rain can percolate freely through it. A tarred surface "scarified" preparatory to remaking may be very dangerous to fish, and care should be taken that the material removed is not left lying where rain-washings from it will enter fishing waters. Oil-droppings from motor traffic are, speaking broadly, unlikely to be directly mischievous, but indirectly they may be injurious through destruction of insect life, on which the fish depend for their food supply.

DR. GEORGE FERDINAND BECKER, who was on the staff of the United States Geological Survey since 1879, died on April 20 in Washington, at the age of seventy-two. His name will always be associated with the days when the survey, by the liberality and the wide distribution of its publications, began to make itself known throughout the scientific world. Becker's work was mostly devoted to the geology of important mineral deposits, and he showed again and again how mining development assisted in the understanding of the relations of rock-masses in the crust. His monograph on "The Geology of the Comstock Lode," published in 1882, directed attention, at a comparatively early date, to the importance of the study of thin rock-slices with the microscope, and its beautiful series of illustrations followed only three years after those issued by Fouqué and Lévy in their famous "Minéralogie micrographique." The width of range in Becker's work is further illustrated by his bulletin on "Schistosity and Slaty Cleavage" (1904), in which he urged that rock-cleavage is due to a weakening of cohesion, antecedent to rupture, on planes of maximum slide, supporting his thesis by experiments on natural clays.

BY the death of Mr. Richard H. Curtis on May 21 meteorology has lost one who took a keen interest in its various branches for more than half a century. Mr. Curtis entered the Meteorological Department of the Board of Trade under Admiral FitzRoy in 1861. For a long time he prepared for the Press the results of the work of observatories, and in 1907 he became superintendent of the instruments and observatories division of the Office. For many years Mr. Curtis lived at Warlingham, Surrey. He retired from the Meteorological Office in 1912 at the age of sixty-five, but continued to supply anemometric records to the Office and rainfall records to *Symons's Meteorological Magazine* until a few months ago. He was a fellow of the Royal Meteorological Society, and served on the council for several years. Mr. Curtis contributed many papers to the society's Journal on various subjects, and especially on sunshine and wind-force. He introduced an improvement in the mounting for the lens and bowl of the Campbell-Stokes sunshine recorder, and carried out interesting experiments on the distribution of wind-pressure upon flat surfaces. He also aided in working up the atmospheric effects of the Krakatoa eruption of August, 1883, the results of which were incorporated in the report by the Royal Society.

MR. E. TORDAY contributes to the April issue of *Man* an interesting account of the Northern Babunda tribe, an offshoot of the Kimbundu of Angola. They are a fine, tall, heavy-boned, short-legged, very dark skinned race, with pleasant features. With the exception of infants they are all clothed, not in Manchester goods, but in cloth home-made from the fibre of the raphia palm. All negroes are keen traders, and trade is the principal occupation of the men; but a great market is scarcely ever held which does not end in a fight between two hostile factions. The crops of the field belong to the woman who tilled it, and it is her duty to feed her husband and her children. Large numbers of slaves are kept, who may be freely sold, but the owners cannot put them to death. No persons who can trace a common ancestor are allowed to marry, and prenuptial infidelity is the normal rule. They are fond of music, and sing better than any other tribe on the Congo. A large collection of their musical instruments has been made for the British Museum.

THE attention of coleopterists may be directed to Dr. F. H. Gravely's "Contribution towards the Revision of the Passalidæ of the World" (Memoirs Indian Museum, vol. vii., No. 1, pp. 146+16 figs.+1 plate, December, 1918), in which, in addition to the systematic part, the external morphology, classification, and geographical distribution of these beetles are discussed.

THE Commonwealth Bureau of Meteorology has published in one sheet a layer-coloured orographical map of Australia on an approximate scale of 4½ millions. The map has been compiled by Dr. Griffith Taylor, who has collected all the available data for the task. In the little known and the unexplored parts of the country the contours are only roughly approximate; in fact, Dr. Taylor describes all the contours as form lines. A note appended to the map gives the authority for the data used in each State. Some improvement might well be made in the lettering and printing, but the map, on the whole, is a useful production and a great improvement, from the orographical point of view, on pre-existing maps. It may be taken for the time being as the authoritative version of the relief of Australia.

AN interesting experiment on the registration of distant earthquakes is described by Messrs. T. A. Jaggar and A. Romberg in the Bulletin of the Seismological Society of America (vol. viii., 1918, pp. 88–89). An Omori horizontal pendulum was used, but the smoked paper and stylus were replaced by an optical system. The arm of the pendulum was continued by a magnetised steel needle. A second needle of the same size was fixed to the back of a light circular mirror, at right angles to the mirror, and with its north pole close to the south pole of the arm magnet. The mirror was cemented to a vertical taut silk fibre held on a post standing on a concrete table, and both pendulum and mirror were damped by projections immersed in oil. During a horizontal displacement of the ground the supports of the pendulum and mirror were moved, while the frictionless magnets rotated the mirror round a vertical axis. The seismogram reproduced (July 2, 1918), made on a Kodak film travelling at 32 mm. per minute, shows the first and second preliminary phases with extraordinary clearness.

IN connection with recent efforts to promote the cultivation of sugar in Bihar, Rai Bahadur Joges Chandra Ray publishes an interesting article in the Journal of the Bihar and Orissa Research Society (vol. iv., part iv.) on the sugar industry in ancient India. In the Vedas there is no mention of any saccharine substance other than honey. Cane was cultivated, but we do not know whether it was used for chewing or pressed, or whether its juice was dried for future use. The original seat of the cultivation of the Paunda, or thick cane, seems to have been northern Bengal. We do not know how the ancients clarified the cane-juice or refined their sugar. Probably the method was much the same as that which obtains now in Bengal and elsewhere, and clarification was secured by skimming off the scum which rises to the surface. It is remarkable that no account of palm-sugar is found in ancient Sanskrit works, and the industry in Bengal seems to be of comparatively recent date. There is a prejudice against its use as the tree yields an intoxicating beverage.

BULLETIN No. 3 of the Scientific and Industrial Research Department consists of a study of the performance of night glasses by Mr. L. C. Martin, of the Imperial College of Science, London. The work arose out of the exacting demands the war made on the optician for a telescope suitable for observing in a feeble light, and the object was to determine the best proportions and conditions of use of an instrument with a given size of objective. The author's conclusions may be summarised as follows:—The binocular form is most convenient. For hand binoculars for general purposes a magnification of 6 should not be exceeded. The exit pupil should be 0·7 or 0·8 cm. in diameter, and a large field of view is desirable, as it increases the ease of observation. For stand instruments a magnification of 10 is most suitable for general purposes. Where higher magnification is necessary it is of the utmost importance to protect the observer's eye and the field of view from all stray light. To diminish the number of glass air surfaces, a cemented prism erecting system should be used.

A PAPER contributed by S. L. Archbutt and D. Hanson at the recent meeting of the Institute of Metals describes in detail the methods found most suitable for the preparation of specimens of aluminium alloys for microscopic examination. Particular care must be given to the grinding and polishing operations, since the successful development of the microstructure depends to a very large extent on the condition of the prepared surface. Hand-grinding on graded emery papers which have been previously soaked in paraffin is found to give excellent results, while for the polishing operation a motor-driven disc covered with smooth-surfaced woollen cloth is employed. Magnesia is used as the polishing powder, but for soft alloys the final stages are carried out on a wet pad practically free from magnesia. With regard to the etching both of aluminium and its alloys, the authors recommend a 10 per cent. solution either of caustic soda or of hydrofluoric acid in water. Methods for the identification of the various impurities occurring in aluminium and of the different micrographic constituents found in the commoner aluminium alloys are also described. These have been investigated in great detail with the object of finding reagents which will distinguish between these different constituents when they occur in the same alloy. Alloys of aluminium with silicon, iron, copper, zinc, nickel, magnesium, and manganese are considered in this connection.

WE are very glad to see that M. L.-P. Clerc, who is so well known in this country, and took up military duties at the very beginning of the war, has resumed his activities in connection with the French Photographic Society. In a recent issue of the society's Bulletin M. Clerc publishes a paper (reproduced in the *British Journal of Photography* for

May 16) on the use of alcohol for the rapid drying of gelatine negatives and prints. He gives curves that show the drying action of alcohol under various conditions, but perhaps the most interesting result is the cause of the white deposit that so often appears when this method is used. It is due to bicarbonate of lime deposited because of its insolubility in alcohol. By immersing the negative in very weak hydrochloric acid (10 c.c. of commercial acid to a litre of water) immediately before putting it into the alcohol, the deposition is avoided. This weak acid will remove a deposit that has been allowed to form, and if the patch is of small area it may be made to disappear by breathing on it for a short time, because of the moisture and carbon dioxide in the expired air. Of course, the use of soft water obviates this annoyance, but the use of pure alcohol instead of "denatured" spirit does not, though this has often been prescribed as a remedy.

MORE than sixty years ago Pasteur showed that glycerol was formed during the alcoholic fermentation of sugar. The quantity found was about 3·6 per cent. of the sugar fermented. Later, Laborde showed that the quantity of glycerine produced varied according to the kind of yeast used and its amount, more than double the foregoing proportion being obtained in some cases. Even so, this is a very small yield if fermentation is regarded as a source of glycerol. It is understood, however, that during the late war our opponents supplemented their production by fermentation methods when fats, the ordinary source, ran short. In *Helvetica Chimica Acta* (vol. ii., No. 2) K. Schweizer indicates the method used. It is known that glyceric aldehyde and dihydroxyacetone can be converted into glycerol by means of reducing agents, and there is some evidence that one or both of these substances may be produced as intermediate compounds during fermentation. The working hypothesis, therefore, was that these compounds, in the nascent state, would be acted upon by a reducing agent and converted into glycerol to a greater extent than in ordinary fermentation. This was found to be the case. On adding sodium sulphite, and working with a neutral liquid, a yield of more than 21 per cent. of glycerol was obtained.

MONOMETHYLAMINE being a synthetic reagent of considerable importance, a new method for its preparation will probably be of interest to organic chemists. The reduction of chloropicrin yields different products according to the reducing agent employed. Raschig showed that when chloropicrin is reduced with stannous chloride and hydrochloric acid, cyanogen chloride is produced. If, however, iron-filings and acetic acid (Geisse) or tin and hydrochloric acid (Wallach) are used, monomethylamine is the major product. Prof. P. F. Frankland and Messrs. F. Challenger and N. A. Nicholls have studied the conditions of the reaction (Journal of the Chemical Society, February, p. 159) and recommend the following procedure:—Iron-filings (500 grams) are gradually shaken into water (2500 c.c.) containing hydrochloric acid (60 c.c.), and contained in a large earthenware jar which is fitted with a stirrer and placed in a little cold water. The chloropicrin (250 grams) is then gradually added, with very efficient stirring. The temperature rises, and should be maintained at about 50° C. The smell of chloropicrin disappears after three hours, and the mixture is then gradually added to a boiling solution of sodium hydroxide into which steam is blown. The methylamine is absorbed in hydrochloric acid, the solution evaporated, and the residue dried to constant weight. In this way a yield of 95·5 per cent. of the amine hydrochloride containing only 3·5 per cent. of ammonium chloride is obtained. When reduced with a hot alkaline solution of ferrous sulphate, chloropicrin gives a considerable amount of ammonia. The method described for the preparation of methylamine should prove valuable now that large quantities of chloropicrin are readily procurable.

A NEW weekly journal devoted to industrial and engineering chemistry, and entitled the *Chemical Age*, is announced for publication on June 21 by Messrs. Benn Bros., Ltd., Bouverie Street, E.C.4.

OUR ASTRONOMICAL COLUMN.

THE SOLAR ECLIPSE.—The total eclipse of the sun that will happen to-day is remarkable for the small amount of attention that is being given to observations of the corona and the sun's surroundings that have formed the main object for which eclipse expeditions have been organised during the last half-century, but in place of these the opportunity is being used to make investigations in several modern branches of science. The Committee of the British Association for Radio-telegraphic Investigation has arranged a programme for sending and receiving signals to determine their strength during the eclipse. The Department of Terrestrial Magnetism of the Carnegie Institution of Washington has arranged observing parties at stations in America and West Africa, who, in co-operation with various observatories and individuals, will make special magnetic and allied observations inside and outside the shadow belt. As has already been announced, the British expeditions to Brazil and West Africa will photograph the field of stars around the sun for the purpose of detecting any displacement due either to gravitation according to the relativity theory published by Einstein in 1915, or to the effect of the sun's gravitation on the mass that light is believed to have according to the electromagnetic theory.

JUNE METEORS.—Though twilight is strong in the midsummer month, meteors are fairly numerous, and probably more so than in April and May. Fireballs are often seen, and particularly from a radiant point in Scorpio. There is a possible cometary radiant on June 10 from 273×0, and three others during the last week of the month from 313×60, 13×6, and 213×53. The last appears to be probably connected with the comet of Pons-Winnecke, which afforded an unusually rich shower on June 28, 1916. Though no return of this display can be confidently expected until 1921 or 1922, it should be looked for every year, as it may form an annual exhibition, though really abundant at intervals of about every six years. The great shower of Perseids begins early in July, and there is strong evidence that the same system furnishes an occasional meteor at the end of June. Observers should therefore watch especially for such an object during the moonless nights at the end of June this year.

PARIS OBSERVATORY REPORTS.—The reports of the French National Observatory have been made and presented to the council annually during the war, and those for the years 1916–18 have lately been received. The work has naturally been much curtailed owing to the absence of many of the staff on military service, and a projected modification of the programme with the principal meridian instrument has had to be held in abeyance. Also, it was considered prudent to take precautions against damage to this and other instruments, so that the reports show little in the way of observation, the energies of such observers as were available being devoted entirely to the requirements of the time service, the errors of the clocks being

determined by the smaller instruments, and to some extent by the *astrolabe à prisme*, which has been confided to the care of Mme. Chandon. In the middle of the year 1918 a provisional observatory was installed at Lyons, to which the astrolabe and other instruments for determination of time were transferred. M. Henri Renan has retired from the service of the observatory after forty-four years' service, and M. Puiseux, who entered the observatory in 1879, resigned his office in the year 1917.

THE ATLANTIC FLIGHT.

THE safety of Mr. H. G. Hawker and Comdr. Mackenzie-Grieve, after their daring attempt at a direct flight across the Atlantic, is at present the feature of special interest. The *Times* of May 26, referring to the news, says "it will cause as keen and as widespread a joy as the news of many a victory in the war." Without doubt the safety of the two airmen has lifted a cloud which threatened to overshadow other competitors.

Much fog was encountered immediately after the start from Newfoundland, and, later, cloud and a squally northerly wind. The flight was made chiefly at an elevation of about 10,000 ft. A direct course for the British Isles was being made, and the aircraft had completed one-half of the journey eastward when, according to Mr. Hawker, "the machine stopped owing to the water-filter in the feed-pipe from the radiator to the water-pump being blocked up with refuse." It is said that there was no trouble in landing on the sea, and Mr. Hawker and Comdr. Grieve were picked up by the Danish tramp steamship *Mary* in lat. 50° 20′ N. and long. 29° 30′ W., after being in the water about one and a half hours, at 8.30 a.m. G.M.T. on May 19.

The *Mary* left New Orleans on April 28, bound for Denmark. Fortunately, this vessel was close at hand when the aircraft was in difficulty. An examination of the wireless weather reports published by the Meteorological Office in the International Section of the Daily Weather Report indicates that Atlantic liners were apparently nowhere near at the time.

From weather maps prepared, it seems that fair north and north-west winds were blowing from Newfoundland to about mid-Atlantic, with cloudy weather, the conditions being chiefly anticyclonic. Further eastward there was a cyclonic disturbance which occasioned gales and heavy weather. This storm system hovered in about the same position to the westward of Ireland for a fortnight, which, meteorologically, is very exceptional, its passage being barred by a region of high barometer which has persistently hung over Scandinavia. Such anomalies offer a decided difficulty to trans-Atlantic flying, although with more perfect engines and further improvement in the flying machines these difficulties will, without doubt, be overcome in time.

We join with the entire British public and others in hearty congratulations on the happy ending of the venturesome and courageous voyage.

The *Daily Mail* has generously decided to give a consolation prize of 5000*l.* for division between Mr. Hawker and his navigator.

The United States Navy seaplane N.C.4, which accomplished a flight to the Azores from Newfoundland on May 16–17, left Ponta Delgada on May 27 and arrived at Lisbon on the same evening. This stage of the journey was about eight hundred miles, and the third stage to Plymouth, by which the trans-Atlantic flight is to be concluded as we go to press, is about nine hundred miles.

CARNEGIE LIBRARIES AND EDUCATIONAL WELFARE.

THE fifth annual report (1918) of the Carnegie United Kingdom Trust was submitted by the executive committee to the trustees on February 26, and has now been published (Edinburgh: T. and A. Constable). The work of the Trustees suggests that, as it is the fashion now to create new Ministries, there is a splendid opportunity for the Prime Minister to appoint a Minister of Philanthropy. Mr. Carnegie, with the most benevolent intentions, spent about two millions on libraries, and, while undoubtedly many towns owe him gratitude for his gifts of fine buildings, we fear the balance would show that he probably did more harm than good. Many of these libraries have proved to be mere white elephants, their upkeep in many cases practically exhausting the whole of the available income, resulting in miserably paid and ineffective staffs, and nothing left for the purchase of books. In some cases less than 1*l.* has been spent on books during an entire year. Whether or not Mr. Carnegie realised this before the end of his personal benefactions we cannot tell, but he very wisely handed over a large sum to carefully chosen trustees, who from the first have laid themselves out to amend past mistakes and make sure that fresh benefactions should be granted with some surety of lasting good results; they have, therefore, steadily refused to make building grants where the yield of the rate is inadequate for the maintenance of a proper library.

The trustees have taken education and the welfare of the people in the widest sense for their province, and they have made the renewal of their annual grants dependent on results. The report is well worth reading. Taking as their model the excellent Yorkshire Village Library scheme, which for more than fifty years has done so much for the working classes, the trustees have established and maintained rural circulating libraries throughout the country, including both Scotland and Ireland, some under the county education authorities, some in relation with town libraries, and others under the charge of the local clergy or schoolmasters. They have established and supported play centres for "toddlers"—that is, children below five years—and, for older children, cricket, football, and other games, all complete with pavilions and everything necessary. In fact, their motto for all such enterprises appears to be "thoroughness." Baths and wash-houses have not been forgotten, and one of their most recent experiments is the encouragement of music by offering rewards for compositions, which are published when judged worthy by their experts. Recognising that music takes a very high place among the instruments for elevating and refining the mind, they have requested Sir Henry Hadow to "investigate and describe the agencies which exist for promoting the practice and appreciation of the art of music among the people of the United Kingdom, and to report what steps might be taken towards their further encouragement in the future." Under the direction of Dr. Terry, considerable progress has been made with the recovery of the works of the musicians of the Tudor period and the transcription of them into modern notation.

The trustees have made a grant of 4000*l.* to the National Union of Women Workers for travelling welfare exhibitions in England and Scotland, the expenditure to be spread over two years; and a sum of 750*l.* for the same purpose has recently been paid to the Women's National Health Association for Ireland. Taught by their five years' experience, they direct special attention to that blot on our public

library system, the limitation of the rate, which prevents even the most powerful of our corporations spending whatever they think fit for the maintenance and development of their library systems. If there is to be any real reconstruction in the educational system of this country, this obstacle to progress should receive the immediate attention of the Government.

RECENT RESEARCHES ON CHOLERA.[1]

THE subject I have chosen to speak about to-day is one regarding which probably but little is known outside the medical profession except that a great reduction in the death-rate has been brought about in recent years in perhaps the most justly dreaded disease of India, namely, cholera. I propose to give you a brief account of my prolonged researches extending over more than a decade, and dealing with several distinct problems by means of a variety of methods of research, physiological, physical, and chemical, as I think this work will best illustrate the value of various collateral sciences in medical research.

The treatment of cholera at the beginning of the twentieth century remained much as it was seventy years before, when Latta and Mackintosh in Edinburgh in 1831 introduced the plan of injecting large quantities of normal saline solution into the veins to combat the collapse stage of cholera. This brilliant idea just failed to be a great discovery because no means were then found of retaining the fluid in the circulation, so that the apparently miraculous immediate effect of reviving the patient as one from the dead was usually followed by fatal recurrence of the terrible drain of fluid from the system. At the time I commenced my investigations the method was seldom used, as shown by the fact that a search through the records of the Calcutta European General Hospital from 1895 to 1904 showed no case in which large saline intravenous injections were given, while the mortality among ninety-five cases in those nine years reached the appalling figure of 87·4 per cent. Indeed, it was generally recognised that once a European patient reached the collapse stage in cholera recovery scarcely ever took place.

Recent Researches on the Treatment of Cholera.

As the first whole-time professor of pathology in Bengal, the home of cholera, who stuck to unlucrative research work for any length of time, this fell disease naturally attracted my attention, but it was not until after the completion of the first edition of my work on fevers in the tropics, the collection of material for which occupied me for twelve years, that I was able to take up serious work on cholera in 1908. I had previously made a number of blood-counts, and, with the help of my friend Major Megaw, had studied in 1906 Latta and Mackintosh's plan of injecting large amounts of normal or isotonic salt solutions—that is, one containing the same proportion of salts as the normal blood, controlling the quantities injected by special blood, and blood-pressure examinations—in the hope that, with the aid of these modern methods, better results would be obtained. This hope was largely disappointed, as the mortality only fell from 59 per cent. during the previous eleven years to 51·9 per cent. in 1906, and the method, which is a time-consuming one, was once more abandoned as of little service.

On thinking the matter over while on furlough, it occurred to me that on the physiological principle that a high salt content tended to retain fluid in the blood, it would be worth while to try a stronger salt solution, and on return from leave with renewed energy at the end of 1907 I determined to put this theory to the test. Up to that time the strength of salines generally advised in cholera was 0·6 per cent., although recent physiological text-books have raised the figure for normal saline to 0·85 per cent. As I wished to give a hypertonic solution—that is, one containing more salt than the normal blood—I doubled the former strength and used a 1·2 per cent. of sodium chloride, or 120 grains to a pint, to which I afterwards added 4 grains of calcium chloride, because physiologists have found the latter salt to be beneficial to the heart. Capt. (now Lt.-Col.) Mackelvie very kindly carried out the hypertonic injections on the cases under his care, while I made a series of observations on the blood, to be related presently. The results may be summarised in a sentence by saying that by using two teaspoonfuls of common salt to a pint of water instead of one, the mortality from cholera was nearly halved. Nothing could well be simpler, yet nearly eighty years had elapsed since salines were first injected intravenously in cholera before the physiological principle of using a hypertonic instead of an isotonic solution was established. It was at once clear to me that a great advance had been made, which stimulated me to persevere with my investigations of the blood-changes in cholera, so as to place the whole subject on a firm scientific basis.

The Blood-changes in Cholera as a Basis for the Hypertonic Treatment.

In the first place, I estimated the amount of chlorides in the blood before and after saline injections in a series of cases, and found that in the most severe cases they might even be below the normal point in spite of the great concentration of the blood, thus establishing a vicious circle and leading to further rapid loss of any isotonic solution injected into the veins. I further established that the hypertonic saline did materially raise the salt content of the blood, and to the greatest extent in recovering cases, which explained both the failure of the former isotonic and the success of the hypertonic solutions.

Another important point was to estimate the amount of fluid lost from the blood in cholera, so as to ascertain if the amount was in proportion to the severity of the case, and to learn how much salt solution it is necessary to inject to replace the loss. For this purpose I centrifuged a few drops of defibrinated blood obtained by pricking the finger-tip in a graduated capillary tube, and measured the volume of the solid corpuscles and of the fluid serum. By comparing the figures obtained with those of normal blood the percentage of fluid lost from the blood could be estimated. For example, in a severe case only 18 per cent. out of the original 55 per cent. of serum remained, showing a loss of no less than 67 per cent. of the fluid portion of the blood as a result of the copious evacuations. A series of such observations indicated that in mild cases of cholera not showing any serious collapse an average of 35 per cent. of the serum was lost; in collapse cases recovering after the hypertonic saline injections the loss averaged 52 per cent.; while in extremely severe cases, who were lost in spite of the new treatment, the figure averaged no less than 64 per cent., or almost two-thirds of the fluid of the blood. I have seen cases of cholera in which the blood was so thick that on opening a vein a drop of black blood slowly exuded having the consistency almost of tar—a condition which must rapidly terminate fatally if not quickly relieved. By repeating these estimations immediately after several pints of saline had been run rapidly into a vein in collapsed cholera cases, I was able to ascertain the quantities required to restore the

[1] From the presidential address delivered to the Indian Science Congress, Bombay, 1919, by Lt.-Col. Sir Leonard Rogers, F.R.S.

normal fluidity of the blood, and found them, as I had suspected, to be much greater in severe cases than had formerly been given when isotonic solutions were in use. The hæmocrite, however, is too much of a laboratory instrument to be generally available, so a simple bedside method was needed. I therefore made use of Lloyd-Jones's method of estimating the specific gravity of the blood by means of a series of solutions of glycerine in water in small labelled bottles into which small drops of blood are gently blown from a capillary tube, and that in which one just floats is noted, which gives the required estimation. Whenever the pulse tends again to fail, the test is repeated as a guide to further treatment, and in several extremely severe cholera patients more than thirty pints of fluid have thus been injected in the course of several days with ultimate success in saving the lives of the patients.

Permanganates and Other Drugs in the Treatment of Cholera.

The success of the hypertonic saline injections in enabling the collapse stage of cholera largely to be overcome opened the way to a trial of drug treatment such as had never before been possible; for it is clear that, unless the circulation can be restored and maintained, drugs given by the mouth will not even be absorbed, and can have no chance of exerting their beneficial action. Great care is required to make such tests trustworthy on account of the numerous sources of fallacy in estimating the effects of a given treatment. The best plan is to use a new drug in every other case in addition to the routine treatment, the remaining half of the cases then serving as a control. To take an example of this method of investigation, the late Sir Lauder Brunton some years ago advocated on physiological grounds the use of atropine in cholera, but was only able to try it in two mild cases with inconclusive results. I therefore gave the drug hypodermically in addition to the routine treatment in every other case of cholera in my wards for a whole year with the result that the mortality was much lower in the atropine series, while a careful comparison of the two sets of cases as regards their severity showed them to be strictly comparable. I have, therefore, added atropine to my system of treatment with, I am sure, beneficial results. In a similar manner emetine was found to be useless in cholera.

Another point I wish to emphasise is the importance of carefully studying one's failures rather than being elated with any success, as the further progress I have still to relate is mainly due to my adopting that practice. For the last ten years I have tabulated with the aid of shorthand—of the value of which in my work I cannot speak too highly—all the more important points of my cholera cases, now amounting to a little more than two thousand, and have closely studied the records of all fatal cases to ascertain the reasons for the failures with the view of finding means of lessening them. The following examples will illustrate some of the results thus obtained.

After an experience of a year and a half of the hypertonic treatment I realised that something more was required if the mortality was to be reduced still further. The failures appeared to me to be due largely to a recurrence of the collapse on account of absorption of the toxins produced by the cholera bacillus in the intestinal canal with the restoration of the circulation after the saline injections. Now the toxins are contained in the bodies of the innumerable bacilli, and set free when they break up, as they do in enormous numbers, for it has been shown that no fewer than 90 per cent. of comma bacilli die in culture-tubes within forty-eight hours. The use of intestinal antiseptics may very possibly add to the toxin absorption by killing the bacilli, which is, I believe, one of the reasons for their failure, as already stated. I therefore sought for some method of destroying the toxins themselves while still unabsorbed in the bowel; and, bearing in mind that they are largely albumoses and other unstable albuminous products of the metabolism of the organisms, and that such substances are readily destroyed or rendered inert by oxidisation, I experimented with various oxidising agents, and particularly with permanganates, which are well known to destroy rapidly *in vitro* the albumoses of snake venoms—a point at which I had previously worked. I was thus able to demonstrate that several times a lethal dose of dead comma bacilli containing the toxins could be neutralised by a small quantity of permanganates. A trial of large doses of permanganate of potash in pill form by the mouth, as much as one hundred grains sometimes being given in the course of several days, in addition to the hypertonic treatment, reduced the mortality of cholera during a year's use from 32·6 to 23·3 per cent., and it has now been used for more than nine years in my wards with increasingly favourable results. Permanganate pills have also been used in cholera epidemics in both the Bombay Presidency and the Central Provinces, in villages under conditions in which the saline treatment was not practicable, and favourable results have been reported, although, of course, it cannot by itself save the most severe cases with extreme collapse.

Alkalis in the Prevention of Fatal Renal Complications.

There still remained one very important line of investigation, which has recently led to a further substantial reduction of the death-rate of cholera by enabling the common and most deadly suppression of the renal function largely to be averted. I know of nothing more disheartening than, after successfully maintaining the circulation by hypertonic salines through a life-and-death struggle for several days and nights, to be unable to get the kidneys to resume their functions, with ultimate loss of the patient. As the losses from collapse were steadily reduced by the various measures I have related, the death-rate from kidney failure continued much the same, and now became the most important remaining cause of loss of life, and it was apparent that some factor remained which was not clearly understood.

Light was first thrown on this problem by an American physician, Dr. Sellards, working in the Philippines, who suspected a diminution in the alkalinity of the blood, or acidosis as it is generally termed, because he found that large doses of alkalis by the mouth failed to make the urine alkaline as it would do in health. He therefore added sodium bicarbonate to the saline solution used in cholera for intravenous injections, and obtained a marked reduction in the death-rate from renal failure. In 1911 Major Megaw, when acting for me in Calcutta, read Sellards's work, and tried alkaline solutions intravenously in cases of cholera with suppression of urine, but with disappointing results, the measure being apparently too late once this complication had become established. Early in 1912 I therefore commenced an investigation of the changes in the alkalinity of the blood in cholera, which Sellards had not then done, and finding an extreme degree of reduced alkalinity in all cases with fatal kidney trouble, with the help of Capt. Shorten, and later of Rai Satish Ch. Banerjee Bahadur, of the Physiological Department, I made a long series of such estimations in cholera cases, with the result of demonstrating that a very marked degree of diminution of the alkalinity of the blood occurred in all cholera cases, while once it reached the extreme degree of N/100 from a normal of about N/25 fatal

suppression of urine took place in spite of very copious alkaline injections. It thus became clear that in all severe cholera cases sodium bicarbonate should be added to the hypertonic saline solution as a routine measure to combat the acidosis from the first, and prevent it reaching a dangerous degree. The results of this addition to the treatment were soon apparent, and after three years' use of the alkaline solutions the death-rate from renal complication among nearly six hundred cases had fallen to 2·98 per cent. from a figure of 11·1 per cent. during the previous three years, or a reduction of 74 per cent. in the losses from this deadly complication, and the last remaining cause of death in cholera was thus largely conquered.

The Diminution in the Mortality of Cholera.

The results may be very briefly summarised in the following table, showing the mortality under the different forms of treatment, or rather the continued elaboration of my system of treatment with increasing knowledge derived from combined clinical and pathological investigations extending over twelve years, and culminating in a reduction of the mortality between 1895 and 1905, before I began work, of 59 per cent. to one of 19·1 per cent. between 1915 and 1917, or one-third of the former rate, while in 1917. among 208 cases, it was but 14·9 per cent., or one-fourth of the earlier figure, although all cases admitted moribund and dying before a saline injection could be given, thus coming late in a hopeless state from suppression of urine, and very young and very old persons without the stamina to allow the treatment to have a fair chance, are included. I therefore think it may fairly be claimed that cholera has now been robbed of most of its terrors by simple scientific investigation with the aid of physical methods in the use of the hæmocrite and specific gravity test, chemical research in the use of permanganates to destroy the toxins in the bowel, and alkalis to combat the deadly acidosis and physiological principles leading to the use of atropine and the all-essential hypertonic saline injections. More may yet be done, but sufficient has already accrued to prove the inestimable life-saving and economic value of medical research work, and to encourage both administrative authorities and philanthropists to look on liberal expenditure on medical research as the best possible use of public and private money.

Table of Cholera Mortality under Different Methods of Treatment.

Years	Cases	Deaths	Mortality, per cent.	Recoveries per cent.
Normal Saline subcutaneously and per rectum.				
1895 to 1905 ...	1243	788	59·0	41·0
Normal Salines intravenously.				
1906	112	57	51·9	49·1
Normal Saline subcutaneously and per rectum.				
1907	158	94	59·5	40·5
Hypertonic Salines intravenously.				
1908 to 7–1909 ...	294	96	32·6	67·4
Hypertonic Salines *plus* Permanganates.				
8–1909 to 1914 ...	858	222	25·9	74·1
Hypertonic Salines, Permanganates, and Alkalis.				
1915 to 1917 ..	638	122	19·1	80·9

The Future of Medical Research in India.

The great lesson to be derived from the researches on cholera which I have related is the importance of combined clinical and pathological investigations. So strongly do I hold the necessity of medical research workers being in the closest possible relationship with large hospitals to enable them to work on practical lines that I regard Pasteur's great discovery of his preventive treatment of hydrophobia as having been a curse rather than a blessing to India, because it has led to three important research laboratories being placed on remote hilltops for the sake of the relatively insignificant mortality from hydrophobia, to the grave detriment of work on all the more important tropical diseases. Now that the treatment of hydrophobia and other bacteriological methods can be carried out in the plains with the help of a refrigerator, as is being done at the present time in Rangoon, no excuse for further repetitions of this grave mistake remain.

The serious disadvantage which so many of the members of the bacteriological—or, as it should be called, medical research—department now labour under by their divorce from large hospitals in the plains will be partly removed when the schools of tropical medicine in Calcutta and Bombay are opened, when team-work so essential to the solution of the larger medical problems will be possible. In addition, all the larger hospitals should have whole-time pathologists, to enable the abundant clinical material they contain to be made available for research purposes, and also to allow the clinical staff and the patients to have the immense advantages in the diagnosis and vaccine and other lines of treatment which a bacteriological laboratory affords through recent advances in our knowledge of medicine. For example, fevers and dysentery are the two great causes of disease and death in India, but it is only with the help of microscopical examinations that they can be rapidly diagnosed and efficiently treated, and without this aid even the most experienced physicians too often cannot do full justice to their patients. In future, I understand pathologists of our medical colleges will be supplied from the bacteriological or research department, and will make the subject their life-study, and not be eligible for clinical posts. In order to get the medical officers with the highest abilities and scientific training required for success in research to devote their lives to it, and to abandon the much more lucrative clinical side of medicine, it will be absolutely necessary to give them salaries in proportion to the long and expensive scientific training of from six to eight years which they receive after finishing their general school education.

Now that the war has led to careful inquiries into scientific education in Great Britain, and a greatly increased demand for men of science at home, the difficulty in recruiting those required for industrial and educative progress in India will be much greater than hitherto, while it will be still further enhanced by the uncertainty of the prospects of young men coming to India for their life's work in Government service due to the proposed ten-yearly kaleidoscopic changes in the constitution of this country. I have felt it to be my duty to point out the rocks ahead in this direction, and to indicate the absolute necessity for much more generous treatment in the immediate future of men of science of all branches of knowledge required for service in India.

The Need for Liberal Endowments of Medical Research in India.

Lastly, I wish to direct attention to the great life-saving and economic importance of such investigations as those which I have related on cholera, and many others which might be mentioned; as when this is fully realised by the public, endowments of medical research will surely be forthcoming in India on a far larger scale than hitherto. Bengal and Bihar have generously given me seven lakhs for the Calcutta School of Tropical Medicine, half of which has been expended on the Carmichael Hospital for Tropical Diseases, and the remainder will be used for medical research and the partial upkeep of the hospital under

a governing body of medical experts. In addition, the Tea, Jute, and Mining Associations are contributing 60,000 rupees a year for the support of three additional workers to investigate on practical lines those diseases which affect the value of the labour forces. Bombay has always been noted for the liberality of her citizens, so I confidently appeal to this great city to do at least as much for my friend Col. Liston's school here, which he has laboured so long and patiently to found in connection with the Parel Laboratory.

Now that the world-wide devastation and the destruction of irreplaceable human life have at length ceased, I should like to see the flow of money diverted to the noble object of saving life by means of a great extension of medical research, and I can conceive of no more fitting thank-offering for the delivery of the world from the greatest menace that has ever threatened modern civilisation.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

BIRMINGHAM.—The Council of the University has approved of the representation of the non-professorial members of the teaching staff on the faculties, the representatives to be elected by the non-professorial members. Hitherto this privilege has been confined to the faculty of medicine, but it is now to be extended to the other faculties. It is proposed that there shall be three representatives on the faculty of science and two on the faculty of arts.

CAMBRIDGE.—The question as to whether the University is prepared to accept financial assistance from the Government under the conditions laid down in Mr. Fisher's letter, referred to last week (p. 229), will be submitted to the Senate on May 31, when the following grace will be offered:—That (1) the Vice-Chancellor be authorised to inform Mr. Fisher that the University would welcome a comprehensive inquiry into its financial resources instituted by the Government, and give every assistance in its power; and (2) pending such inquiry the Vice-Chancellor be requested to draw the attention of the Government to the pressing need for an emergency grant.

The Goldsmiths' Company has agreed to give a sum, not exceeding 5500*l.*, to the University for the purpose of extending and equipping the department of metallurgy. The Goldsmiths' readership in metallurgy was founded by the company in 1908, and Mr. C. T. Heycock was appointed reader. The metallurgical department was at first housed in two rooms in the chemical laboratory, but the number of students rapidly increased, and when the department of agriculture left the chemical laboratory in 1910, Sir William Pope assigned the rooms thus vacated to metallurgy. The Goldsmiths' Company most kindly contributed the sum of 800*l.* for the alteration and equipment of these rooms. Furnaces, muffles, and high-temperature recording apparatus were installed, as well as the necessary assay and other balances. In addition, the apparatus used by Messrs. Heycock and Neville in their work on alloys was moved from their private laboratory into the new rooms, which thus became provided with a complete photomicrographic equipment. The number of students working at metallurgy has now increased beyond the capacity of the present laboratory, and the generous gift of the Goldsmiths' Company will provide a new analytical laboratory, with benches supplied with compressed air and high- and low-voltage direct current, a balance room, and also a room for general galvanometer and photographic work, with gas furnaces round the walls. Accommodation for sixteen students working at assaying and general mineral analysis and for ten research students will thus become available.

Mr. R. I. Lynch, who has been curator of the University Botanic Garden since 1879, has resigned his office on medical grounds. Before coming to Cambridge Mr. Lynch had held the post of senior foreman at Kew. Under his care the Botanic Garden has played a most important part in the University teaching, and the University showed its appreciation of his scientific work by conferring upon him in 1906 the honorary degree of M.A. His devotion to the welfare of the garden, and his readiness to assist all who made demands upon his unrivalled knowledge, have gained for him the respect and affection of many friends, and his departure from Cambridge will be greatly regretted.

OXFORD.—Notice is given of the forthcoming election to a tutorial fellowship at Exeter College for the teaching of chemistry. Applications must be sent to the Rector of the college by June 10. The fellowship is of the annual value of 200*l.*, *plus* certain allowances.

Government grants to University institutions in Oxford have hitherto been limited in amount, and confined to one or two departments which were doing work of special importance to the Government. The question of larger subsidies has now been raised, partly on the initiative of the Government itself. Reluctance has always been felt by many in Oxford to seek pecuniary aid in this manner, from the apprehension that it might lead to the sacrifice of academic independence. It is certain that no grant would be given without a comprehensive inquiry into present resources and the use being made of them, and it remains to be seen whether the prospect of much-needed financial assistance will outweigh the dislike of interference with the autonomy so much prized by a large number of members of the University.

The Halley lecture was delivered by Prof. Horace Lamb at the University Museum, on May 20, before a large and appreciative audience. In dealing with the subject of the tides, Prof. Lamb directed attention to the discrepancy between the theoretical outcome of calculation and the actual phenomena experienced, pointing out that the equilibrium theory is a theory of tidal forces, not of their results. The method of computation originated by Kelvin and George Darwin, known as the method of harmonic analysis, rested on a combination of theory and observation. It was suggested some fifty years ago that the tides might give some idea of the rigidity of the globe as a whole. Kelvin pointed out that if the interior of the earth were fluid, tides would occur internally. Pendulum experiments had shown, by deflection of the plumb-line, that the earth does yield somewhat to tidal influence. Its rigidity is about equal to that of a globe of steel.

DR. GISBERT KAPP is about to resign the professorship of electrical engineering in the University of Birmingham.

MR. W. THOMSON, hitherto head of the physics department of Battersea Polytechnic, has been appointed principal of the Croydon Polytechnics.

DR. H. PRINGLE, lecturer on histology in the University of Edinburgh, has been appointed to succeed

the late Sir Henry Thompson in the chair of physiology in Trinity College, Dublin.

APPLICATIONS will be received until June 28 by the British Medical Association, 429 Strand, for an Ernest Hart memorial scholarship, value 200*l.* per annum, for the study of some subject in the department of State medicine, and for three annual research scholarships, each of the value of 150*l.*, for research in some subject relating to the causation, prevention, and treatment of disease.

CAPT. EUSTACE H. CLUVER has been appointed to the new chair of physiology at the South African School of Mines and Technology at Johannesburg. Capt. Cluver went as a Rhodes scholar to Hertford College, Oxford, in 1914, and took a First Class in the Final Honour School of Physiology in 1916. After a varied medical experience he went out to the front with the South African Medical Corps, where he was engaged until the time of the armistice.

THE following munificent benefactions towards the cost of developing the work of the Imperial College of Science at South Kensington are announced:—Mr. Otto Beit, a member of the governing body, has placed at the disposal of the governors the sum of 10,000*l.*, to be used for building and equipment purposes for such departments of the college as may be found most urgently to require assistance for development; and an old student of the Royal College of Science has contributed a sum of 8000*l.* for the equipment of an intermediate-scale laboratory in organic chemistry, a new building for which is now in course of erection.

THE eighth annual meeting of the Old Students' Association of the Royal College of Science, London, was held on May 24, Prof. H. E. Armstrong presiding. A resolution was adopted appointing a special committee to consider and report on the reorganisation of the association to an adjourned meeting to be held in October. Sir Richard Gregory was elected president for 1919. A discussion took place on the question of raising the status of the Imperial College to that of a university, in the course of which Mr. T. Ll. Humberstone, secretary of the association, expressed strong opposition to the proposal, which, he considered, would entail endless friction, as well as disorganisation and duplication of effort. The annual dinner was held in the evening at the Café Monico.

AN invitation has been sent by the Chief of the Imperial General Staff to the universities and other institutions of higher education to nominate representatives to a conference on June 11 and 12 with representatives of the Dominions, to discuss educational problems that have presented themselves to the Imperial Education Committee of the War Office as a result of experience gained in the working of the educational schemes within the British Army and the Forces of the Dominions. The conference will be held in Australia House. The Chief of the Imperial General Staff will preside at the opening session, when an address will be given by Mr. Fisher, President of the Board of Education. Lord Milner, Sir Henry Hadow, and Sir Daniel Hall will preside at subsequent sessions, when reciprocity between the universities of the Empire in the organisation of study and research to meet the technical, commercial, and agricultural needs of the Empire will be discussed. Sir Henry Hadow has relinquished the post of Assistant Director of Staff Duties (Education), and Mr. P. A. Barnett, formerly Chief Inspector of Training Colleges, has been appointed Civil Adviser to the Educational Department of the Staff Duties Directorate, War Office.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, May 15.—Sir J. J. Thomson, president, in the chair.—Prof. W. H. **Young**: (1) The area of surfaces. Many attempts by well-known writers have been made to frame a theory of the area of surfaces. These efforts have been attended with so little success that even the most recent text-books define the area of a curved surface by means of the formula known to hold in the case of a surface of revolution. Not even in the matter of the definition itself has anything which can be regarded as final been achieved, still less has it been found feasible to proceed from the definitions which have been given to the formula required. In the present communication the author attacks the question from an entirely new point of view. The definition given is based on what is itself a new concept, namely, that of the area of a closed skew curve. It is characterised further by the use to which is put the idea that the surface is, like a curve, an ordered manifold, the order being double instead of single. The surface is accordingly supposed defined by equations of the form

$$x=x(u,v) \qquad y=y(u,v) \qquad t=t(u,v)$$

and divided up by the curves

$$u=\text{const.} \qquad v=\text{const.}$$

On the fact that the sum of the areas of the boundaries of the portions of surface thus obtained has a unique limit, the definition of the area of a surface is based. The curve boundaries have, in fact, an area whenever they possess a length. Moreover, the unique limit obtained for their sum is shown under very general conditions to have precisely the value given by the well-known formula. (2) Change of the independent variables in a multiple integral.—Prof. W. A. **Bone** and R. J. **Sarjant**: Researches on the chemistry of coal. Part i.: The action of pyridine upon the coal substance. The paper records the results of an experimental investigation of the so-called solvent action of pyridine and homologues upon the coal substance, with the double object of clearing up certain discrepancies in the work of previous investigators and of determining the real nature of the action in question. It is shown that the presence of oxygen has an important retarding action upon the extraction process (the extent of which varies considerably with the nature of the coal), and that in order to obtain consistent results in any such process it is necessary not only to employ an anhydrous solvent, but also to exclude oxygen. The application of the method to two typical isomeric bituminous coals is fully described. It is shown that when such extraction is carried out at ordinary pressures, with exclusion of oxygen, a practical limit is finally attained. In the case of the two coals in question, this limit considerably exceeded the amount of "volatiles" yielded by them on carbonisation at 950°. At higher pressures this first limit was considerably passed, and when conducted in sealed tubes between 130° and 150° as much as two-thirds of the coal substance was rendered soluble.—Prof. E. F. **Burton**: A new method of weighing colloidal particles. When fine colloidal particles are dragged up and down for equal periods in a liquid by the application of a vertical electrical field a net settling of the particles is noted. It is thought that, though for small forces such as gravity alone the Brownian movement prevents the attainment of any limiting velocity, yet when the particles are dragged by a much larger force the comparatively insignificant gravitational force is added to the electrical for downward motion and subtracted for upward motion, thus becoming effective in producing a net

settling of the particles. Application of Stokes's law to this net settling gives a value for the size of the particles very closely agreeing with that obtained by the counting method (*e.g.* $2{\cdot}2\times10^{-5}$ cm. and $1{\cdot}7\times10^{-5}$ cm.), even though values to hand are taken from old observations made when this net settling was not appreciated and not closely observed. Experiments are now in hand to determine this settling very exactly.—W. E. **Curtis**: The value of the Rydberg constant for spectral series.

Royal Meteorological Society, May 21.—Sir Napier Shaw, president, in the chair.—Capt. C. J. P. **Cave** and J. S. **Dines**: Further measurements on the rate of ascent of pilot-balloons. The paper discusses experiments made, in continuation of previous work, on the rate of ascent of pilot-balloons measured in a closed building. The building used in the present case was the Royal Albert Hall, which is very suitable for the purpose, inasmuch as a clear height of 40 metres is available from floor-level to the grid at the centre of the domed roof. The formula in general use in this country for the rate of ascent is, rising velocity $V=q\sqrt{L}/\sqrt[3]{W+L}$, where L = the free lift and W the dead-weight of the balloon, and q is a constant the value of which is to be determined under different conditions. It had previously been suggested that the value of q varied with different degrees of loading of the balloon. Attention was directed to this question, and quantitive results were obtained. Measurements were also made with a candle-lantern of the pattern used for night ascents hung below the balloon. It was found that this produced no effect upon q. In timing the rate of ascent in closed buildings a fine thread has generally been attached to the neck, and has been drawn up from the floor as the ascent proceeded. In the present case experiments which were made with and without such a thread showed that some correction is necessary where a thread is used. The general results confirmed the value $q=84$, which is used at the present time, for balloons of the size generally adopted for pilot-balloon work. This value gives velocities in metres per minute when lift and dead-weight are expressed in grams.—J. Edmund **Clark** and H. B. **Adames**: Report on the observations for the phenological year, December, 1917, to November, 1918. The excessive cold of December, 1917, was followed by three mild months, February in particular. Hence by April 1 blackthorn was in most parts blooming, whereas after the very cold early months of 1917 the mean date was thirty-five days later than in 1918. Rarely has the farm and garden promise at this date been so satisfactory. Then came the mid-April bitter weather, disastrous to the opening fruit-tree buds, and a continuation of summer drought and coolness continued the prejudicial conditions. A genial August greatly favoured the earlier harvesting districts, but the excessive wet in September caused damage and loss elsewhere. The whole autumn was cool, but comparative dryness in October and November helped finally in the harvesting of nearly average field crops. Potatoes gave a record for acreage and yield per acre, but after storage there was serious loss from disease. The migrant records support the interesting weather relationships shown by the other tables. The April cold delayed the appearance of the sixteen earlier birds two or three days more than the other ten. The isophenal lines on the map indicate the districts where the plants of Table III. blossomed simultaneously. Their course shows the marked influence of elevation. On the same map are also shown the isotherms for the first half of the year, and a comparison of these with the isophenes is a matter of considerable interest.

PARIS.

Academy of Sciences, May 5.—M. Léon Guignard in the chair.—A. **Lacroix** and A. **de Gramont**: The presence of boron in some natural basic silico-aluminates. A spectroscopic examination of saphirine, kornerupine, and grandidierite showed that boron had been overlooked in the analyses. In the order named there were present 0·75 per cent., 3·59 per cent., and 2·81 per cent. of boric anhydride. The boron may be considered as replacing aluminium isomorphically in these minerals. The results of the spectroscopic examination of other minerals for boron are given.—H. **Deslandres**: Remarks on the constitution of the atom and the properties of band spectra. A discussion of the formulæ expressing the general structure of band spectra, with reference to the various hypotheses on the composition of the atom.—C. **Depéret**: An attempt at the general chronological co-ordination of the Quaternary epoch.—Ed. **Imbeaux**: The navigable waterways of Alsace and Lorraine. An account of the actual position of water-carriage in these provinces and the modifications which they will want in the immediate future to meet the industrial requirements, including the transport of coal from the Saar basin, oil from Pechelbronn, iron from the Lorraine mines, potash from Mulhouse, soda salts, cements, and other industrial products.—M. **Defourneaux**: Some properties of electro-spherical polynomials.—G. **Julia**: Uniform functions with an isolated essential singular point.—G. **Guillaumin**: Certain particular solutions of the problem of sandy flow where the massif considered comprises two regions governed by different laws.—Ed. **Urbain** and C. **Scal**: The decomposition of dielectric liquids surrounding an arc. It was necessary to use metallic electrodes in these experiments, as the separated carbon then remained in suspension in the liquid. If the liquid is maintained at 15°, the decomposition products are different from those obtained when the liquid is allowed to boil. Some particulars of experiments with tin tetrachloride, titanium tetrachloride, carbon tetrachloride, some hydrocarbons, and ketones are given.—A. C. **Vournasos**: The normal nitrides of nickel and cobalt. If nickel cyanide is heated with nickel oxide to a temperature not exceeding 1000° C., the only products of the reaction are carbon monoxide, nitrogen, and metallic nickel. If, however, these two substances are rapidly heated to more than 2000° C., the products are carbon monoxide and nickel nitride, Ni_3N_2. The corresponding cobalt nitride is formed in a similar reaction.—A. **Kling** and R. **Schmutz**: The estimation of traces of carbonyl chloride in air. The air is passed through aqueous aniline, and the diphenylurea formed by the phosgene determined either by weighing or by conversion into ammonia. For quantities varying from 0·22 to 0·44 milligram of $COCl_2$ per litre the error averaged 5 per cent. of the amount present.—M. **Picon**: The action of the monosodium derivative of acetylene upon some primary alkyl iodides with branched chains.—E. **Fleury**: The signification and *rôle* of *lapiesation* in the disaggregation of granitic rocks in Portugal.—G. **Guilbert**: The prediction of barometric variations.—P. **Thiéry**: New observations on the system of geological accidents called the *Faille des Cevennes*.—L. **Léger** and E. **Hesse**: A new parasitic Coccidium of the trout. This new species, for which the name *Goussia truttae* is proposed, has been observed in wild trout from the neighbourhood of Grenoble. A full description is given.—S. **Stefanescu**: The co-ordination of the morphological characters and of the movements of the molars of elephants and mastodons.—R. **Fosse**: The simultaneous oxidation of blood and glucose. Urea is produced by this oxidation.—G. **Bertrand** and Mme. M.

Rosenblatt: The comparative toxic action of some volatile substances upon various insects. The comparative effects of the vapours of ether, chloroform, carbon bisulphide, carbon tetrachloride, monochloroacetone, benzyl bromide, chloropicrin, and prussic acid upon the larvæ of *Bombix neustria* have been studied. Chloropicrin proved to be the most toxic.

BOOKS RECEIVED.

Dr. John Fothergill and his Friends: Chapters in Eighteenth-century Life. By Dr. R. H. Fox. Pp. xxiv+434. (London: Macmillan and Co., Ltd.) 21*s.* net.

The Geographical Part of the Nuzhat-al-Qulūb. Composed by Hamd-Allāh Mustawfī of Qazwīn in 740 (1340). Translated by G. Le Strange. "E. F. W. Gibb Memorial" Series. Vol. xxiii., No. 2. Pp. xix+322. (Leyden: E. J. Brill; London: Luzac and Co.) 8*s.*

L'Origine des Formes de la Terre et des Planètes. By E. Belot. Pp. xii+213+iii plates. (Paris: Gauthier-Villars et Cie.) 14.40 francs net.

The Intuitive Basis of Knowledge: An Epistemological Inquiry. By Prof. N. O. Lossky. Translated by N. A. Duddington. Pp. xxix+420. (London: Macmillan and Co., Ltd.) 16*s.* net.

Industrial Chemistry. By Dr. C. Ranken. Pp. 126. (London and Edinburgh: T. C. and E. C. Jack, Ltd., and T. Nelson and Sons, Ltd.) 1*s.* 3*d.*

A Geography of America. By T. Alford Smith. Pp. x+329. (London: Macmillan and Co., Ltd.) 4*s.* 6*d.*

A Vision of the Possible: What the R.A.M.C. Might Become. By Sir J. W. Barrett. Pp. xx+182. (London: H. K. Lewis and Co., Ltd.)

Elements of Graphic Dynamics. By E. S. Andrews. Pp. viii+192. (London: Chapman and Hall, Ltd.) 10*s.* 6*d.* net.

Animal Life and Human Progress. Edited by Prof. A. Dendy. Pp. ix+227. (London: Constable and Co., Ltd.) 10*s.* 6*d.* net.

The People's Health. By W. M. Coleman. Reprint. Pp. xi+370. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd.) 3*s.* 6*d.* net.

Productive Agriculture. By Prof. J. H. Gehrs. Pp. xii+436. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd.) 5*s.* 6*d.* net.

Manual of Lip-reading. By Mary E. B. Stormonth (Mrs. F. H. Mann). Pp. ix+208. (London: Constable and Co., Ltd.) 5*s.* net.

The Essentials of English Teaching. By Members of the English Association. Pp. 11. (London: Longmans and Co.) 1*s.*

The Peace Conference Atlas. Maps 24. (London: E. Stanford, Ltd.) 5*s.*

DIARY OF SOCIETIES.

THURSDAY, MAY 29.

INSTITUTION OF ELECTRICAL ENGINEERS, at 2.30.—Annual General Meeting.

ROYAL INSTITUTION, at 3.—Sir Valentine Chirol: The Balkans.

ROYAL SOCIETY, at 4.30.—Croonian Lecture—Dr. H. H. Dale: The Biological Significance of Anaphylaxis.

ROYAL AERONAUTICAL SOCIETY, at 8.—Squadron-Commander G. M. Dyott: Flying in South America.

FRIDAY, MAY 30.

ROYAL INSTITUTION, at 5.30.—Sir John R. Bradford: A "Filter-passing" Virus in Certain Diseases.

INSTITUTION OF MECHANICAL ENGINEERS, at 6.—Discussion resumed by Dr. W. Rosenhain on Paper by Dr. W. H. Hatfield: The Mechanical Properties of Steel, with some consideration of the Question of Brittleness.

ILLUMINATING ENGINEERING SOCIETY, at 8.—F. W. Willcox: The Gas-filled Lamp and its Effect on Illuminating Engineering.

SATURDAY, MAY 31.

BRITISH PSYCHOLOGICAL SOCIETY, at 3.30.—F. E. Bartlett and Miss E. M. Smith: Listening to Sounds of Minimal Intensity.—E. Bullough: The Relations of Æsthetics to Psychology.

MONDAY, JUNE 2.

VICTORIA INSTITUTE, at 4.30.—E. Walter Maunder: The Mosaic Calendar as a Means of Dating approximately certain Ancient Writings.

SOCIETY OF ENGINEERS, at 5.30.—A. Stewart Buckle: Re-settlement of Officers in Civil Life.—T. J. Gueritte: The Unknown Versailles.

ARISTOTELIAN SOCIETY, at 8.—Very Rev. Dean W. R. Inge: Platonism and Human Immortality.

SOCIETY OF CHEMICAL INDUSTRY, at 8.—Informal Meeting.

TUESDAY, JUNE 3.

ROYAL INSTITUTION, at 3.—Prof. W. H. Bragg: Listening under Water.

WEDNESDAY, JUNE 4.

GEOLOGICAL SOCIETY, at 5.30.—A. Smith Woodward: The Dentition of the Petalodont Shark, Climaxodus.—F. Debenham: A New Theory of Transportation by Ice: the Raised Marine Muds of South Victoria Land (Antarctica).

THURSDAY, JUNE 5.

ROYAL INSTITUTION, at 3.—Sir Valentine Chirol: The Balkans.

ROYAL SOCIETY OF ARTS, at 4.30.—Lord Montagu of Beaulieu: Aviation as Affecting India.

CHEMICAL SOCIETY, at 8.—W. H. Perkin: Cryptopine. Part II.—P. Blackman: An Isotonic (Isosmotic) Apparatus for comparing Molecular Weights. Part I.—V. Cofman: The "Active Substance" in the Iodination of Phenols.—N. V. Sidgwick: The Influence of Orientation on the Boiling-points of Isomeric Benzene Derivatives.—J. Senior: The Atomic Weight of Iodine, and the Discovery of a New Halogen.—H. Hepworth: The Absorption Spectra of the Nitric Esters of Glycerol.

FRIDAY, JUNE 6.

ROYAL INSTITUTION, at 5.30.—Sir E. Rutherford: Atomic Projectiles and their Collisions with Light Atoms.

SATURDAY, JUNE 7.

ROYAL INSTITUTION, at 3.—J. M. Price: The Italian Front.

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