THURSDAY, JANUARY 2, 1913.

RACES OF MANKIND.

Homo Sapiens. Einleitung zu einem Kurse der Anthropologie. Autorisierte Übersetzung aus dem Italienischen. By Dr. Giuffrida-Ruggeri. Pp. viii + 198. (Vienna and Leipzig: A. Hartleben, 1913.) Price 5 marks.

THE author of this work, who holds the chair of anthropology in the University of Naples, has come in recent years to occupy a place among the leading anthropologists of Europe. He has taken a part in every one of the recent international discussions relating to the origin of man and the separation of mankind into modern races. On every occasion he has shown himself to possess a wide and intimate knowledge, a clear and simple style, and an exceedingly well-balanced judgment.

The present work, which has been honoured by a translation into German, is marked by all these virtues, and will serve as an excellent and systematic introduction to all those problems which at present occupy the attention of anthropologists. The chief problem concerns the single or multiple origin of modern races of mankind. The author, after discussing all the evidence produced in favour of a multiple origin—the facts produced by Klaatsch, by Kollmann, by Ameghino, by his colleague Sergi, who fills the chair of anthropology in Rome, comes to the conclusion that all modern races are descendants of a common stock and are single in their origin. Modern races all belong to the one species, *Homo sapiens*, but it is a species made up of a collection of well-marked varieties, each variety being, in his opinion, a potential species. The characters revealed by the fossil remains of extinct races convince him that in the past there have been several species of mankind, *Homo sapiens* being the only surviving species. As regards the number of varieties or subspecies of modern races of mankind, the Neapolitan professor quotes with approval the statement of Prof. von Luschan, of Berlin, "That it is as difficult to give their number as it is to estimate how many angels could dance on the point of a needle"!

The principles which underlie the knowledge we apply to the evolution of man must rest on the laws of heredity. Hence in the first chapter of this book, which has the merit of very moderate dimensions, Prof. Giuffrida-Ruggeri discusses the problems of heredity and seeks to apply Mendel's law to man, depending especially in this chapter on the writings of Bateson, Davenport and Hurst. He is apparently inclined to believe that mutation has been an active factor in the differentiation of modern races, but is sceptical of convergence having played any part in human evolution.

It would take us too far afield to summarise the remaining chapters of the book; it is sufficient to state again that the work is the best introduction yet published to the modern problems of man's origin. A. K.

IRRITABILITY OF PLANTS.

Die Reizbewegungen der Pflanzen. By Dr. Ernst G. Pringsheim. Pp. viii + 326. (Berlin: Julius Springer, 1912.) Price 12 marks.

DR. PRINGSHEIM disarms criticism by stating in his preface that he is writing rather for the layman than for his professional colleagues. We fancy, however, that there will be few plant physiologists who will peruse the book without gathering something from it, here and there an out-of-the-way fact, or a new impression—the result of skilful handling of his material on the part of the author.

It is true that the book does not, perhaps, add much that is new to our stock of knowledge, and that sometimes one is disposed to dissent from the conclusions to which Dr. Pringsheim arrives. But there is a freshness about the whole work, coupled with a sense of first-hand acquaintance with the experimental evidence under review, which lifts it far above the level of a mere compilation.

Indeed, it is open to question, perhaps, whether the book, as a whole, will not appeal rather to the physiologist than to the non-botanical reader, in spite of the intention conveyed by its author. Some of the pages dealing with geotropism are good reading, and really provide an excellent summary of the principal results at present attained. The layman, however, will probably want to know what Piccard's methods (p. 49) of investigation on geotropism were, and it is not easy, without a previous familiarity with the apparatus, to follow the discussion of Haberlandt's investigations on similar lines. The statolith theory of geotropic perception is very briefly discussed, and some of the difficulties in the way of its acceptance are pointed out; the judicial conclusion is reached that we have not yet heard the last word on it.

The treatment of periodic movements is interesting, but perhaps more open to criticism than most of the rest of the book. The distinction between truly irritable movements and growth, which may accompany them, seems scarcely to be kept in sight sufficiently.

Several of the specially interesting examples of plant-movement receive careful treatment, and amongst them chemiotaxis is fairly fully discussed, but no very satisfactory conclusion is arrived at—a result which is quite justified by, and in accordance with, the present state of knowledge.

In the general summary there occurs an excellent suggestion as to the general attitude to be maintained towards the whole subject of irritability by a wise investigator.

Although it may not be possible as yet to give a complete or satisfactory explanation for the irritable manifestations of life, or of the manner in which they are produced, it is nevertheless on the suggested lines that advance may still be most profitably made. Even if we are as yet ignorant of many things in chemistry and physics which are necessary to the solution of the problems, it is better to search in those directions than to delude ourselves with psychical explanations which are no real explanations at all, but mainly serve to bar real advance by substituting elusive phantasy for ascertainable fact. At the best, they may be useful in checking too ready dependence on crude mechanistic hypotheses. For this is apt to be the sin of those who desire to run along the road of the "exact sciences" faster than the way is securely built, or even exactly traced.

J. B. F.

COPPER SMELTING.

Modern Copper Smelting. By Donald M. Levy, Pp. xii+259. (London: C. Griffin and Co., Ltd., 1912.) Price 10*s.* 6*d.* net.

THE book consists of the lectures given by the author before the senior students of metallurgy at the University of Birmingham, considerably extended, and is based partly on a study of the practice as conducted at some of the most important copper-smelting works in America, and of the records of the advances in the metallurgy of copper contained in recent technical literature. Incorporated in it are also the personal experiences of the author during a stay at the works at Anaconda and at others in Tennessee.

In the first four lectures are given brief accounts of the history and uses of the metal and of the preliminary preparation of the ores for smelting. As regards the roasting of ores, the modern type of furnace is indeed described, but the space devoted to this important operation might be extended with advantage in the next edition of the book.

The use of the reverberatory furnace, which, not long ago, was considered by some to be passing into obsolescence and was almost everywhere being displaced by the blast-furnace, has, during recent years, again come to the front on account of its suitability for the smelting of fine ores.

New furnaces of extraordinary length and other dimensions have been erected at Anaconda and elsewhere, and are worked with a greater economy of fuel and labour than the smaller furnaces which formerly were universal in this country.

Copper-smelting generally, however, is conducted on a much less magnificent scale than at the Anaconda works, and it would have been well if the description of the furnaces and practice there had been supplemented by an account of the practice and type of furnace that would be best adapted for works of moderate size. This remark also applies to lecture vi., on blast-furnace practice, in which the Anaconda plant again receives chief attention.

The lectures on bessemerising and copper-refining contain a good summary of these processes, but are wanting in one or two details.

The foregoing criticisms are offered in a friendly spirit, as the book is a good one, an excellent summary of modern copper-smelting practice, and should be in the hands of every student of this subject.

W. G.

PERSONAL AND PUBLIC HEALTH.

(1) *Perfect Health for Women and Children.* By Elizabeth S. Chesser. Pp. xi+276. (London: Methuen and Co., Ltd., n.d.) Price 3*s.* 6*d.* net.

(2) *Hypnotism and Disease: a Plea for National Psychotherapy.* By Dr. Hugh C. Miller. Pp. 252. (London: T. Fisher Unwin, 1912.) Price 5*s.* net.

(3) *Modern Sanitary Engineering.* Part i., House Drainage. By G. Thomson, M.A. Pp. xv+266. (London: Constable and Co., Ltd., 1912.) 6*s.* net.

(1) THE author's experience as a woman doctor has frequently shown to her how necessary it is to women, especially mothers, that they should be supplied with information which will be of service to them in health and sickness; and the book which she has written aims at supplying intelligent women with such useful information. The simple facts of hygiene, properly understood and practised, cannot fail to prevent much disease, and a knowledge of the domestic treatment of common ailments will in many cases avert serious complications. Miss Chesser has to be commended for having treated a wide subject in such a sound, common-sense and practical manner as will make the book appeal to every class of reader, both lay and medical. The author

does not mince matters when she finds fault with the unhygienic practices of the present day; and the work is full of good, telling sentences, such as, "if women paid as much attention to their teeth as they do to their complexions, they would be 50 per cent. healthier and better looking."

The right provisions for the healthy child are summarised by the writer in her directions to give the child the right sort of food and make him eat it properly; provide fresh air for him night and day; teach him how to breathe and how to play; train his mind and character; do not "coddle" either in clothing or in diet.

(2) This volume presents the main features of psychotherapy in a form suitable for the intelligent lay reader, and it forms an interesting and instructive work which should appeal to the physician as well as to the layman. The *rationale* of hypnotism and the scope of suggestion in medical practice are clearly defined. The object of hypnotism, as taught in this book, is to render the mind receptive and capable of influencing function; and a merit of Dr. Miller's exposition is its moderation in statement.

With the enlarged understanding of the subject it seems likely that we shall in the future see an increased evidence of the suitable employment of psychotherapeutics; for our highest medical authorities recognise that mental healing has a firm basis of truth and fact, and that it may be properly and safely employed by skilled doctors who have the gift and power to use it, for every mentally healthy individual can be brought under its influence. It is the absence of this power and the failure to cultivate it which has often led to the easier expedient of administering bromides, massage, &c., to neurasthenics, when hypnotic suggestion would constitute a better treatment of the patient.

This treatment by mental methods does not necessarily involve hypnosis, and it includes the very important subject of re-education of self-control. The main object of the book is to show that what the "quack" (religious or medical) can do by fraud, delusion, or mystery can be done by the honest physician who works through the mind on the body, without descending to deception in any shape or form.

(3) This book presents a useful statement upon the practical sanitation of the dwelling, in so far as the provisions for drainage are concerned. As would be expected, seeing that the writer has been lecturing upon sanitary engineering at the Royal Technical College, Glasgow, for some twenty years, the facts are well put, clearly expressed and concisely dealt with in a handy, well-illustrated volume.

OUR BOOKSHELF.

Internaciona Biologial Lexiko en Ido, Germana, Angla, Franca, Italiana ed Hispana. By Dr. M. Boubier. (Jena: Gustav Fischer, 1911.) Pp. vi+73. Price 1.50 marks.

IN 1901 the Delegation for the Adoption of an Auxiliary International Language was founded. This delegation, while approving generally of Esperanto, decided that certain reforms were needed, and as Esperantists would not agree to these, there have resulted two languages, or rather dialects, namely, Esperanto and Ido, of which the latter possesses the advantage that it can be printed without the use of specially accented letters, besides other advantages in the matter of simplicity.

In the "Internaciona Biologial Lexiko," Dr. Boubier has drawn up a vocabulary, for the purposes of this language, of the principal terms used in biology, with their equivalents in German, English, French, Italian, and Spanish. Most of these terms are mere modifications of ordinary biological nomenclature adapted to the grammatical requirements of Ido. In many cases an intelligent reader could guess the meaning of these words, though he would have difficulty in writing them, and in this respect the present nomenclature is better than that used for some of the words in common use.

It is to be hoped that these attempts to find a satisfactory auxiliary language will not result in chaos, for while we have already two rivals in Ido and Esperanto, attempts are being made in other quarters to restore Latin in a modified form to its original position as the language of the learned world, and if science students are still to be required to pass examinations in Latin on the ground that it is *the* fundamental language, they will certainly show some reluctance in learning a second auxiliary language differing greatly from Latin. It will remain to be seen whether Ido is sufficiently near Latin to appeal to the pupils of our public schools.

Who's Who, 1913. Pp. xxx+2226. Price 15*s.* net.

Englishwoman's Year Book and Directory, 1913. Edited by G. E. Mitton. Pp. xxxi+412. Price 2*s.* 6*d.* net.

The Writers' and Artists' Year Book, 1913. Pp. viii+147. Price 1*s.* net. (London: A. and C. Black.)

SOME idea of the comprehensive character of the latest issue of "Who's Who" may be gathered from the fact that it contains 25,000 biographies of men and women in some way distinguished. Due prominence is given in the collection to successful workers in science, and not only are British men of science dealt with, but also those of foreign countries. The editor of this indispensable work of reference may be congratulated upon keeping it up to date and maintaining all its useful characters.

"The Englishwoman's Year Book" serves admirably to show the increasing share educated

women are taking in the useful work of the world. Parents will find helpful guidance here as to the education of their daughters and the opportunities available for them to obtain remunerative labour later in life. The volume should be in the hands of every woman worker.

"The Writers' and Artists' Year Book," in addition to being a handy index to periodical literature, places at the disposal of writers, artists and photographers useful guidance in the matter of disposing of their work satisfactorily.

The Beginner in Poultry. The Zest and the Profit in Poultry Growing. By C. S. Valentine. Pp. x+450. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1912.) Price 6*s.* 6*d.* net.

By the time the "beginner" has read this book he might well think himself something more than a beginner. The keynote of the work is sympathy, and once possessing that, it is hard indeed if one cannot make a success of any hobby in live stock. Naturally, the suggestions as to management are more suited to the States than to this country, but the reader who wishes to take a broad view of aviculture, and is already conversant with the ins and outs of the daily routine, will find much food for reflection by a careful study of many of the chapters. We would specially commend to the powers that be section 22 on poultry schools. When one knows of the hard struggle for existence some of our educational work has had, and the scant support our own Board of Agriculture can offer, it makes one feel somewhat envious of the magnificent grants that are so freely available on the other side. The writer of this notice has had the good fortune to take part in some of the courses alluded to, and knows that such experts as are engaged at Cornell and Corvallis, &c., are past masters in the poultry world, and heartily endorses much of what the book says on this question.

The work contains some 450 pages, and is profusely illustrated, though several of the reproductions are not quite up to the high standard one usually sees in the American Press. Perhaps the author's other book, "How to Keep Hens at a Profit," should be read first. The present volume is rather for the library or student; it does not cater for the exhibitor. Its value is rather to the thinker, and he who thinks is he who rules.

The Montessori System in Theory and Practice. By Dr. Theodate L. Smith. Pp. vii+78. (New York and London: Harper Brothers, 1912.) Price 2*s.* 6*d.* net.

In the review of Madame Montessori's recent book describing her method of scientific pedagogy as applied to child education in "The Children's Houses," published in NATURE on September 26 last (vol. xc., p. 99), some account was given of the system. It is sufficient to say of Dr. Smith's little volume that it provides a convenient introduction to the methods advocated by Madame Montessori, and some reports of American experience of their adoption.

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.*]

British Forestry and the Development Commission.

It is more than two years since the Development Commission obtained its fine grant of 500,000*l.* yearly for five years. There have been Parliamentary grants in addition; thus 900,000*l.* was available the first year. Said *The Times*: "The Development Fund is a remarkable departure from the *laissez-faire* policy which has so long dominated the proceedings of British Governments." It was early announced that one of the chief objects of the Development Commission was British forestry, *including the purchase and planting of land.* One small piece of poor ground in Scotland represents all the land that has yet been acquired in Britain; and foresters are beginning to inquire if we have really broken away from the bad traditions of the past. British forestry has never had such an opportunity as this half-million grant. Will anything practical be done before it is too late and the grant come to an end, because nothing practical has been achieved? It is true that there have been useful educational grants; and promises of loans for forestry, on liberal terms, to "local authorities or other responsible bodies": but this, without State forestry, is putting the cart before the horse. As is well known, the communal forests on the Continent carry a class of forest inferior to the State forests, and they are only kept up to this standard by either State supervision or their management by State forest officers, combined with the stiffening effect of the better managed State forests in their midst.

For fifty years British State forestry has been standing still. Excellent schemes have been prepared. There have been innumerable Parliamentary Committees and reports! Three quite good British schools of forestry training have been established, and, alas! abolished, in spite of the excellent training they were giving. There remains now but one State forest school, the useful institution for instructing woodmen in the Forest of Dean. In the successive abandonment of these Government forest schools we see the want of a permanent forest authority to defend them against the vacillations of political control.

The onus of this failure in forestry—and forestry is perhaps the greatest of the modern arts—lies in the hesitancy of the Britisher to accept State forestry. It is tolerably certain that no material progress in British forestry will ever be made without State forestry, which is the kernel and pith of the whole business. There are two reasons why we must accept State forestry. Only the State can obtain money at a low enough rate of interest (2½ or 3 per cent.) to make forestry pay in this climate of low sun-power. Only the State has the "unending life," viz. a life long enough for successful forest management. A private owner cannot be expected to plant trees for the public good with only the prospect of an uncertain 2 or 3 per cent., going to his son, his grandson, or even his great-grandson. Further, forestry, like so many other industries, must be done on a large scale to yield good returns.

Most of the opposition to State forests is no doubt due to ignorance of what they are. To the uninitiated they may look much like the wild forest that, in parts of the world, has to be largely cut down to make

way for settlement. But, to those who know, the modern cultivated forest is very different. It yields more timber, and its uses "for the healing of the nations" are manifold and of the first importance. The nearer it comes to our doors, the better for us; and happily also the better for the cultivated forest. The wild forest is generally a distant business, not entering into the daily life of the people, a life which the forest can so enrich and enlarge.

The avowed object of the Development Commission when instituted was "to apply State methods long proved successful in other countries and in the Colonies to the development" of these islands. But the Development Commissioners have now formally stated that their *general policy is adverse to State forestry* (Report for period ending March 31, 1911). No reasons are given for the adoption of a decision so strangely at variance with the rest of the civilised world. Germany spends 7,000,000*l.* a year on State forestry. The Prussian Forest Department between 1867 and 1892 acquired 329,850 acres of waste land for re-foresting at a cost of about 1,125,000*l.*, besides granting substantial bounties for planting to private landowners, and giving in one year (1893) about 32,000,000 young trees for planting to private owners of woodlands (Dr. Nisbet). France, with a much smaller forest area, spends half a million yearly on State forestry.

Every country in Europe has its State forests in a more or less advanced condition of development. Most instructive, in this respect, is the excellent forest work of Japan. With a cool head and free hands, unfettered by the traditions of Western Europe, it has calmly appropriated what is good in Western civilisation and rejected the bad. Japan adopted State forestry in the earliest days of its civilisation. It is now spending more than 250,000*l.* yearly on its State forests, and it has some 100 million young trees in its State forest nurseries. The returns show an average of sixty-two million trees planted yearly in the State forests! There are free grants of trees and subsidies for private tree-planting. Instruction in forestry permeates the whole educational system, from the universities to the village schools.

Writing as one who has borne a prominent share in one of the largest works of constructive forestry in recent times, I say without hesitation, let the Development Commissioners frankly accept State forestry and do as the rest of the world. If, thirty years ago, Cape Colony had hesitated at practical State forestry it would not occupy the position it does now.

Cape Colony (now under Union the Cape Province) has spent considerably more than 1,000,000*l.* on its forestry, and it is now producing, within its own borders, the greater portion of the timber imported from abroad at a cost of between 300,000*l.* and 400,000*l.* yearly. Cape Colony has wisely held that it is too poor a country to go on paying out this large sum yearly for imported timber.

Though so little has yet been done for practical forestry in Britain, the Irishman has made his voice heard with the happiest results! He has established an epoch in the history of British forestry with the decision of the Development Commission that "State afforestation on a small scale may be started in Ireland immediately." According to the last returns that have reached me, there has actually been acquired for forest purposes in Ireland an area of more than 7000 acres.

It is a serious reflection that Great Britain, year after year, is spending some twenty-five million pounds sterling on imported timber and forest products, a considerable portion of which could be grown on the waste lands of these islands.

Sir William Schlich, in one of his admirable publications on British forestry ("Forestry in the United Kingdom," p. 23), says: "From time to time suitable tracts of land come into the market and there is, in my opinion, no reason why the State should not acquire such land for re-foresting."

Though little has been done for Scotch forestry, for England and Wales there has been even less. Indeed, no beginning of practical State forestry has yet been made in England and Wales. The mountains of Wales, the Weald of Kent, the Sussex Downs, still show vestiges of their ancient wild forests; and here is the best field (near industrial centres) for the more productive modern cultivated forest. There is no reason, except national improvidence, why the Welsh mines should continue to draw the greater part of their pit props from France; or why the Weald of Kent and the Sussex Downs should not have their ancient beauties restored and become once more a source of local wealth and the joy to the Londoner that the beautiful forests near Paris are to the Parisians. Nowadays it is these accessible forests, close to industrial centres, that yield the best returns, some of them in France and Germany from 2*l.* to more than 3*l.* per acre per year of net revenue. Not very long ago it was remarked to me by a French forest expert that these forests near Paris, financially, were carrying the distant Alpine forests on their backs!

There are considerable areas of poor land within twenty or thirty miles of London that, at a reasonable expenditure, could be turned into rich forests, like the Beech forest of the Chiltern Hills. In the Highlands of Scotland, and on the Welsh mountains, there are climatic difficulties (too frequent mists, too little sun), bogland, and peat. But the south-east of England is free from these climatic troubles. It is everywhere within the climatic limits of vigorous and easy tree growth. Let us not forget that in going from the north of Scotland to the south of England we go half-way to middle Italy and Portugal, where the sun-power gives those enormous yields of timber that are the wonder of foresters in more northern climates, 20 tons of (air-dry, seasoned) wood, or 700 cu. ft. per acre per year.

There are 36,000 acres of heath, waste, or poor pasture land in Kent, Surrey, and Sussex. Labour, especially during the winter months, is abundant. Forest work is of the healthiest kind possible. Nowhere in the world do we see men of finer physique than the small farmers and villagers of Germany, who, in the winter, when other work is scarce, find their salvation in the health-giving forest.

Some 10 per cent. of the industrial population of Germany draw their livelihood from the forest, and Sir William Schlich has computed ("Forestry in the United Kingdom") that under any general scheme of State forestry for the British Isles, there would be employment for some two and a half million labourers in winter, and parts of spring and autumn. Here are far-reaching issues. Parliament has voted the money to put them to the test. And yet we allow insular prejudice to block the way to State forestry, which is the essential feature of modern scientific forestry in other countries.

D. E. HUTCHINS.

Ridley, Kent, December 17.

The Recent Foraminifera of the British Islands.

I AM proposing, with my collaborator, Mr. Arthur Earland, to prepare a Monograph of the British Foraminifera, the work of Williamson being now in serious need of being brought up to date. With this object in view we are sending a preliminary schedule of questions relative to the shore sands of the British Islands to clergymen and medical men at coastal towns

and villages at intervals of a few miles all round the coast. As these gentlemen are strangers to us, I should be very glad to hear from any persons living near the coast who would be willing to receive from us a copy of the schedule and a statement of our preliminary needs. The services which we ask of observers round the coast do not involve any serious trouble, and, of course, no expenses will fall upon those who are willing to assist us.

EDWARD HERON-ALLEN.
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POPULAR NATURAL HISTORY.[1]

(1) MR. SWANTON'S work on plant galls will be welcomed by a wide circle of readers, since it appeals to both the botanist and entomologist. In it the former will find a ready means of identifying the gall-producers which claim his attention, whilst the latter will value the interesting details of insect life-histories. Descriptions are arranged under the headings of gall-producing insects, and chapters are also devoted to growths produced by mites, nematodes, and fungi. The remaining half of the work is occupied by a very complete catalogue of British plant galls, botanically arranged. In the endeavour to cover the whole ground the author has included growths which can scarcely be regarded as galls in the accepted sense. Thus the "Reed Mace" fungus (*Epichloe typhina*) is a mere mass of mycelium outside the plant, there being no hypertrophy of the tissues. It should also be noted that the galls on alder roots are caused, not by *Frankiella alni*, but, as Miss Pratt has shown, by the bacterium *Pseudomonas radicicola*, though the growths may afterwards become infested by the hyphomycete. Bottomley has shown that the similar "galls" on the roots of bog myrtle are produced by the same bacterium.

The work is illustrated by thirty-two plates, of which sixteen are reproductions of excellent colour drawings by Miss M. K. Spittal, and there are also more than thirty text figures.

A male spider near the edge of a web in which the female is at the centre. From "Spiderland."

The author is to be congratulated on a work of great utility and general excellence.

(2) To the majority of the human race spiders are repulsive creatures. They are for the most part devoid of that beauty of form and colour which often ensures a favourable reception to other members of the so-called lower creation. He would, however, be a soulless person who, after reading Mr. Ellis's work, did not regard spiders with respect if not with admiration. As shedding an interesting light on the struggle for existence it is worthy of note that some spiders which resemble ants lay but three or four eggs, whilst less defended orb weavers may lay twelve hundred.

We hesitate to cast a doubt on the wonderful reasoning powers, and especially on the great maternal affection, which the author sees so con-

[1] (1) "British Plant-galls." A Classified Text-book of Cecidology. By E. W. Swanton. With Introduction by Sir Jonathan Hutchinson, F.R.S., and sixteen coloured plates by Mary K. Spittal. Pp. xv+287. (London: Methuen and Co., Ltd., n.d.) Price 7*s.* 6*d.* net.

(2) "Spiderland." By R. A. Ellis. With Photographs and Drawings by the Author. Pp. xxii+198. (London: Cassell and Co., Ltd., 1912.) Price 3*s.* 6*d.* net.

(3) "Elementary Entomology." By E. Dwight Sanderson and Prof. C. F. Jackson. Pp. vii+372. (Boston and London: Ginn and Co., n.d.) Price 8*s.* 6*d.*

(4) "Butterflies and Moths at Home and Abroad." By H. Rowland-Brown. Pp. 271+21 full-page plates. (London: T. Fisher Unwin, 1912.) Price 7*s.* 6*d.* net.

stantly exhibited by his subjects, but we confess that our faith in these attributes is of the weakest. The female Lycosid may carry her own young, but she will also carry any other young family indiscriminately, and the author refrains from telling us that *Atypus affinis* will devour her own brood should they unduly delay their departure from the parental abode. The elaborate nest once begun by Agelena will be carefully completed and guarded, whether the eggs are removed or not. Mr. Ellis tells us that his book is primarily intended for young folk, but it will undoubtedly be of interest both to the naturalist and the general reader.

(3) In this work the authors have provided a text-book for beginners undertaking a course of elementary entomology. The book is divided into three sections, the structure and growth of insects, descriptions of species typical of the orders, and a section containing a series of laboratory exercises, together with a key to the orders and information concerning the apparatus and methods employed in collecting and preserving. We have rarely seen a work in which so large an amount of information is compressed into so small a space, and the text is well and profusely illustrated. Such errors as we have found are but few, and detract little from the general usefulness of the work. The statement that the mouth parts of Lepidoptera are so formed as to preclude injury to vegetation is scarcely correct, since at least two African Noctuids do no small damage to peaches by piercing the skin and sucking the juices, whilst the Australian *Ophideres fullonica* attacks oranges, and, as pointed out by Francis Darwin many years ago, has the proboscis specially modified in adaptation to its habits. The statement that all moths are night flyers seems to require some modification.

So long as there is no universally accepted classification of the Insecta we must refrain from too great comment on this portion of the work, though we think it would have been better to point out the sexual differences in the tarsi of the Nymphalidæ and Lycænidæ, and the Erycinidæ should find a place in even a condensed table. Compared with the general utility of the work these are, however, but small matters, and will doubtless be amended in a second edition, which we fully expect will soon be required.

(4) The author of this work has drawn upon his wide and lengthy experience of collecting to provide an extremely pleasant and readable account of a selection of European Lepidoptera. We confess to a feeling of satisfaction that the work tends to lead the young lepidopterist away from the narrow insularity so long and painfully associated with the old-fashioned British collector. The inflated value often placed on British examples of species which may be pests on the Continent is essentially unscientific. For the collector who can extend his field to the Continent Mr. Rowland-Brown's work provides just the information which will awaken and maintain a healthy interest in the subject.

In criticising the coloured plates one must bear in mind the low cost of the volume, and if the figures are not always typical of the best in lithographic art they are at least free from that crudeness of execution which is not always absent from many more costly productions. Whilst we find no fault with the work itself we trust the author's well-known talents, both as a writer and a naturalist, will soon find expression in a volume of a more advanced type.

NATURAL AND SYNTHETIC RUBBER.

UNDER the above title an interesting address was delivered by Dr. F. Mollwo Perkin before the Society of Arts on December 11. After briefly reviewing the history of the development of the indiarubber industry and the nature of the processes used in extracting the natural product and in vulcanisation, an account was given of the recent synthetic processes by which the manufacture of artificial rubber on the large scale has become a commercial possibility. In the process of the Synthetic Products Co. isoprene is made from fusel oil, which is fractionated so as to give *iso*amyl alcohol, $CH(CH_3)_2 \cdot CH_2 \cdot CH_2 \cdot OH$, which is converted into the chloride, $CH(CH_3)_2 \cdot CH_2 \cdot CH_2 \cdot Cl$ by the action of hydrochloric acid and then into the dichloride $C(CH_3)_2Cl \cdot CH_2 \cdot CH_2 \cdot Cl$ by the action of chlorine, under specially controlled conditions; the dichloride obtained is passed through a tube heated at 470° and filled with soda-lime, whereby it is converted into isoprene, which can be polymerised to rubber by means of small quantities of sodium.

The only difficulty in the way of this process is the cost of the raw product, amyl alcohol, which is about 14*l*. per ton. On this account, Prof. W. H. Perkin, with E. H. Strange, F. E. Matthews, and Prof. Fernbach, devised a process for obtaining butyl alcohol cheaply, from which butadiene could be obtained. By the employment of a certain organism, it was found possible to ferment starch, and, more recently, sawdust, so as to obtain butyl alcohol and acetone, the latter being sold, thus cheapening the cost of the butyl alcohol. The butyl alcohol is chlorinated in the same way as the *iso*amyl alcohol, and by similar treatment with soda lime yields butadiene, $CH_2{:}CH \cdot CH{:}CH_2$, which on polymerisation gives a rubber which, although not chemically identical with the polymerised isoprene, has all the properties of natural rubber in regard to elasticity and behaviour towards sulphur on vulcanisation.

An account was also given in the lecture of the processes devised by the firm of Friedrich Bayer, of Elberfeld, and of the interesting fact discovered by Prof. Harries that the presence of a small quantity of rubber ozonide very much increases the rapidity of polymerisation of isoprene and its derivatives.

In discussing the question of the competition of natural and synthetic rubber, it is pointed out that "at present prices and with the present supply and demand there is no reason, provided synthetic

rubber is as good as natural rubber, why the two should not exist side by side." But the rubber planter is bidden take heed of the lesson taught by the fate of the natural alizarin and indigo industries and consider possibilities of improving the yield of natural rubber by better methods of tapping, coagulation, the study of agricultural conditions, and possible improvements by fertilisation and the suppression of insect pests, which play havoc with the young trees. It is a significant fact that the Badische Anilin und Soda-Fabrik has agreed to put by 1,000,000*l.* for research in connection with synthetic rubber, just as nearly 1,000,000*l.* was expended by the same firm in research before synthetic indigo was placed on the market.

MOVEMENTS OF GLACIERS.[1]

THE seventeenth report of the Commission Internationale des Glaciers makes its appearance for the year 1911, in conformity with the decision at the Stockholm meeting, without waiting for laggard documents. We learn from it that on the Swiss Alps the majority of the glaciers are still decreasing, probably in consequence of the hot summer of 1911, only three showing signs of an advance, the reason of which remains to be discovered. In the Eastern Alps the observations include eight groups out of twelve, and these show that the fairly general advance of 1910 has not been maintained. In the Italian Alps the retreat, except in a few cases, has been general, as in the previous years, that of the southern end of the Brenva Glacier (Mt. Blanc) having been sixty metres.

The report from the French Alps has not yet been received, but it is not likely to differ materially from the others, so that in this chain the diminution which began about half a century ago has now continued considerably longer than the time which was supposed to be its average one. Of the Scandinavian glaciers, four out of the five observed in Sweden show a marked advance. In Norway a larger number has been studied—in Jotunheim twenty-seven, and in different parts of western Norway twenty-three. In the former district only two show an advance, the remainder being in retreat. In the latter about half the Jostedalsbræ are moving one way and half the other, but the Okstind (five) and two of the Frostis (three) are advancing.

The report, owing to early publication, does not include returns from Russia, Asia, and America, so that general conclusions cannot be drawn; but we may perhaps infer that no marked change is likely to be indicated. The value, however, of summarised systematic observations such as these is very great, because they form the first step—and a very long one—in ascertaining the causes which bring about these periodic oscillations of the ice-streams. T. G. B.

1 "Les Variations Périodiques des Glaciers." xvii Rapport, 1911. Rédigé par Charles Rabot et E. Muret. (Extrait des "Annales de Glaciologie," t. vii., pp. 37-47.) (Berlin: Borntraeger Frères, 1912.)

THE PROTECTION OF ANCIENT MONUMENTS.

THE last report of the Inspector of Ancient Monuments, Mr. C. R. Peers, with an introduction by the First Commissioner, Earl Beauchamp, describes the limitations under which the work of the Department is conducted at present. The existing Acts are merely permissive, and the State can exercise no supervision, except with the consent, and indeed by the desire, of the owner. Earl Beauchamp believes that his Department should be invested with the power of intervention when monuments are suffering from neglect, or are threatened with actual damage or destruction, a view in which all antiquaries will concur.

Even under the present restrictions much useful work is being done. The most important operations were at Carnarvon Castle in anticipation of the investiture of H.R.H. the Prince of Wales, in the course of which much ancient work was cleared and repaired. At the Chapel Royal, Holyrood, the discovery of the foundations of an ancient church, with apparently contemporary interments, has disproved the legend that the palace was founded in 1124 on a site till then uninhabited. At the Tower of London the Bell Tower and the turret flanking the Byward Gate had been repaired. At Old Sarum the excavations conducted by the Society of Antiquaries have disclosed the plan of the Castle buildings.

Among the most interesting buildings placed in charge of the Department during the year were the Old Machar Cathedral at Aberdeen; the Gateway Tower of Chester Castle; Richard III.'s Tower at Carlisle; Kirby Muxloe Castle in Leicestershire; and the Bishop's and Earl's Palaces at Kirkwall.

Good progress has been made in the preparation of the County Inventories of Historical Monuments, of which five volumes have been issued, and scientific inquiries are in progress for the prevention of decay in stone-work. It may be hoped that Parliament will soon find time to complete the measures for the adequate protection of historical monuments throughout the country.

NOTES.

THE names of few men associated with scientific work appear in the list of New Year Honours. Three fellows of the Royal Society are among the recipients of honours, namely Mr. Francis Darwin, upon whom a knighthood is conferred; Dr. A. G. Bourne, Director of Public Instruction, Madras, who is made a Knight Commander of the Order of the Indian Empire (K.C.I.E.); and Dr. W. R. Dunstan, director of the Imperial Institute, who has been appointed a Companion of the Order of St. Michael and St. George (C.M.G.). Other names of men known in the scientific world are Sir Frank Crisp, a new baronet, for many years treasurer and vice-president of the Linnean Society, and honorary secretary of the Royal Microscopical Society from 1878 to 1889; Dr. R. W. Philip (knighthood), distinguished by his work

on the etiology and treatment of tuberculosis; Mr. S. Stockman (knighthood), chief veterinary officer to the Board of Agriculture and Fisheries; Dr. W. G. Liston (C.I.E.), director of the Bacteriological Laboratory, Parel, and senior member of the Plague Research Commission; and Prof. P. J. Brühl (I.S.O.), Civil Engineering College, Sibpur.

THE President of the Board of Agriculture and Fisheries has appointed an advisory committee to advise the Board on questions relating to the elucidation through scientific research of problems affecting fisheries. The committee will be composed of the following:—Mr. H. G. Maurice, Mr. F. G. Ogilvie, C.B., Commander M. W. C. Hepworth, C.B., Prof. G. C. Bourne, F.R.S., Prof. J. S. Gardiner, F.R.S., Prof. A. Dendy, F.R.S., Prof. W. A. Herdman, F.R.S., Prof. A. Meek, Dr. A. E. Shipley, F.R.S., Dr. E. W. MacBride, F.R.S., Dr. W. Evans Hoyle, Dr. S. F. Harmer, F.R.S., Dr. G. H. Fowler, and Dr. E. J. Allen. Mr. H. G. Maurice, the assistant secretary of the Fisheries Division of the Board of Agriculture and Fisheries, will act as chairman of the committee, and Mr. A. T. A. Dobson, of the Board of Agriculture and Fisheries, as secretary.

THE Research Defence Society has lately opened a bureau and exhibition at 171 Piccadilly, opposite Burlington House. The windows display a good collection of pictures, photographs, charts, and lantern-slides; apparatus for anæsthetics; germs in test-tubes; specimens of tsetse-flies and mosquitoes; books, pamphlets, and leaflets. They serve to remind "the man in the street" of the immense importance of experiments on animals to the welfare of mankind, and the great saving of human and animal life and health already achieved. Among the pictures is a large engraving of Fildes's "The Doctor," presented to the society by the artist himself. Leaflets are distributed outside. The bureau is in charge of a young lady, who receives signatures and contributions, and enlists new members and associates. The exhibition is quietly attractive to all passers-by.

IT is with regret that we have to record the death of Mr. J. Rowland Ward, the well-known taxidermist, which took place at his residence, Restmore, Boscombe, Hants, on Saturday, December 28, 1912. Mr. Ward, who succeeded to the business started by his father, Henry Ward, was, we believe, the first to raise taxidermy to the rank of a fine art, and to replace the old-fashioned "stuffing" process by modelling the form of the animal, and then covering the "manikin" with the skin. And not only was he the inventor of this method, but the work of his firm has ever since maintained that high standard of excellence which has rendered the name of Ward famous throughout the world. The deceased gentleman was, indeed, a born artist, possessing almost unrivalled skill in modelling animals, and if his energies had not been otherwise fully occupied there is little doubt that he could have attained eminence as a sculptor. In addition to mounting individual animals or their heads, Mr. Ward devoted special attention to big groups of animals, the first of which was a "Combat of Red Deer," shown at the London International Exhibition of 1871. For this and other exhibits of the same nature, as well as for the excellence of his work as a general taxidermist, Mr. Ward received a number of gold medals and other awards. In addition to his business as a taxidermist, Mr. Ward published numerous works on big game and sport. He was, moreover, himself an author, and his "Records of Big Game" and "Sportsman's Handbook," which have passed through several editions, are invaluable both to the sportsman and to the naturalist. Mr. Ward leaves a widow, but no family.

THE death is announced, at ninety-one years of age, of Dr. P. Redfern, formerly Regius professor of anatomy and physiology at Queen's College, Belfast.

MR. J. B. TYRRELL, of Toronto, Canada, a member of the council of the twelfth International Geological Congress, to be held in Toronto in August next, is in London for a short time, stopping at the Hotel Victoria, Northumberland Avenue. He asks us to state that while in London he will be glad to furnish information to anyone who purposes to attend the meeting of the congress.

ON Monday, December 23, the millionth visitor to the Zoological Gardens, Regent's Park, during 1912 passed the turnstile. This is a record attendance, and bears forcible testimony to the appreciation by the public of the improvements which have been effected during the last few years in the gardens. The fortunate individual who completed the million was awarded a free pass to the gardens for 1913.

MR. EDWARD TYER, well known as a telegraphic engineer, and by his inventions in connection with the system of block signalling on railways, died on Christmas night in his eighty-third year. Mr. Tyer was a fellow of the Royal Astronomical Society, and also an associate (1861) of the Institution of Civil Engineers, under its original charter, a member of the Institution of Electrical Engineers, and a fellow of the Royal Microscopical and Geographical Societies.

THE Commonwealth Government has entrusted Prof. A. J. Ewart, professor of botany in the University of Melbourne, with the investigation of the plants collected during the recent Northern Territory exploring expedition, and has appointed Dr. A. Morrison, formerly Government Botanist of West Australia, to assist in the work. Dr. Morrison will reach Melbourne shortly, and it is hoped that the material available will be sufficient for the preparation of a flora of the Northern Territory.

WE learn from *The Times* that M. Liard, rector of the University of Paris, announced at a meeting of the council of the University held on December 27 that the Marquise Arconati-Visconti has decided to supplement her previous gift of 20,000*l.* by a further gift of 20,000*l.* to be devoted "to the benefit of the Faculties of Science and of Letters." It has been decided to use the money for the erection of an Institute of Geography to be built by the side of the Oceanographical Institute, endowed by the Prince of Monaco.

The Museum News for December, issued at Brooklyn, New York, gives a full account of the unrivalled collection of specimens of ancient Chinese cloisonné which has been recently presented to the Central Museum by Mr. S. P. Avery. A complete catalogue of this splendid collection has been prepared by Mr. J. Getz, and is accompanied by a full description of the elaborate processes by Mr. S. W. Bushell.

THE November issue of *The National Geographic Magazine* is remarkable for the large series of excellent coloured photographs which accompany two important articles on modern Russia. The first of these, by Mr. W. W. Chapin, is entitled, "Glimpses of the Russian Empire"; the second, by Major-General A. W. Greely, on "The Land of Promise," gives an interesting account of a journey across Siberia, and describes the enormous bodies of emigrants who are rapidly occupying a region of immense fertility. "Slowly but surely," he observes, "the fuller, freer life of Asiatic Russia is bringing into higher and harmonious relations with its environment the godlike soul of man."

IN *L'Anthropologie* for September–October last, L'Abbé H. Breuil, MM. S. Gomez and C. Aguilo continue their important series of studies of primitive art in the Palæolithic caves of Southern Europe with a description of those recently found at Alpéra, 270 kilometres from Madrid. These drawings exhibit several notable peculiarities. They are nearly all representations, probably magical in intention, of hunting scenes, in which the drawings of human figures, usually thin and elongated, with occasionally pronounced steatopygy, depicting their weapons—bows, arrows, and lances—are peculiarly interesting. In one picture two dames, perhaps of high rank, appear dressed in wide, probably ornamented, petticoats. As some of the figures have been retraced, it is not easy to decide their relation to works of art of the same or similar types, except the conclusion that they probably belong to the earlier Quaternary period. It is to be hoped that this series of valuable contributions to prehistoric archæology will soon be republished in a permanent form and in English.

THE "Live Stock Journal Almanack" for 1913 maintains the high level characteristic of that publication, as well as its wealth of pictorial illustration. The contents include nearly sixty articles, notably one by Lord Northbrook on agricultural societies. Others relate to most of the British breeds of horses, cattle, sheep, and pigs. The least satisfactory is one on the relationships of the different breeds of horses and the ancestry of the group, the author evidently possessing but an imperfect acquaintance with his subject.

IN *Naturwissenschaftliche Wochenschrift* of December 15, 1912, Dr. Killermann-Regensburg gives an account, with illustrations, of pictures of the walrus, the bison, and the elk by Albert Dürer. All three are in the Sloane library at the British Museum; those of the bison and elk having been apparently brought to light but recently by Mr. Harry David, who described them in the first part of the *Jahrbuch der K. preussischen Kunstsammlungen* for 1912. In the early part of the sixteenth century, and indeed up to 1550, bison still survived in Prussia, Hungary, and Siebenbürge, so that Dürer may well have seen a living example. Apart from prehistoric sketches, his picture is the earliest known portrait of the bison.

FROM the time their existence was recorded by Mr. Boulenger, in 1900, the presence of hair-like appendages in the males of certain frogs has been a puzzle to naturalists. A possible clue to their function is suggested by Dr. Bashford Dean in vol. xxxi., art. 29 (pp. 349–351), of the Bulletin of the American Museum of Natural History. The suggestion is to the effect that these hairs may serve to retain the coils of spawn in cases where—as in the midwife-toad (Alytes), which does not, however, develop hairs—they are carried on the bodies and thighs of the males. It is mentioned that hair-like vascular structures are developed on the ventral appendages of the lungfish Lepidosiren, which also possesses the brooding habit.

TO *The Victorian Naturalist* of November, 1912, Mr. J. A. Kershaw communicates some interesting particulars with regard to the breeding habits and young of the platypus. Three burrows on the Hopkins River were dug out in the presence of the author, one on October 26, 1911, and the other two on October 22, 1912. From the first was obtained a female with two recently hatched offspring, and from the others eggs, a pair in one case and a single one in the other. When the first female was taken a young one was clinging to the belly so tightly that some little effort was required to detach it; its fellow had fallen off unobserved when the parent was dragged from the trench. None of the burrows had an entrance below the normal water-level, and in some cases the entrance was so high up on the bank that it would be submerged only by very exceptional floods. After the eggs are hatched the female parent remains for some days with the young in the burrow, which she blocks with earth in several places, probably as a protection against flood-water, or possibly against enemies.

MESSRS. H. E. JORDAN and K. B. Steele have published an interesting account of their work on the intercalated discs of heart muscle in *The American Journal of Anatomy* (vol. xiii., 1912, 151). Mr. H. E. Jordan had reached the conclusion in a previous paper, from his study of the discs in the heart muscle of humming birds, that these discs were not intracellular elements marking cell boundaries as maintained by Zimmermann and others. In the present paper, which is a comparative study in the microscopy of cardiac muscle, the authors adduce evidence in support of the contention of Mr. Jordan. They maintain that the discs are to be interpreted in terms of local contractions in the muscle fibrils, and that this explanation accounts for the great variety in formation and structure (of the discs) which is found. Further, they hold that the presence of these discs seems to be related in some way to the function of rhythmic contraction which is characteristic of cardiac muscle. In support of this hypothesis they advance the following facts. (1) The discs are absent in the heart of the mammalian fœtus,

but they increase in number with age; (2) they are located in lines corresponding roughly with the axes of the heart muscle mesh; (3) they are generally found present in greatest abundance in hearts of rapid beat; and (4) they are also present in the striated muscle of the media in the proximate (beating) end of the pulmonary arteries; for example, in those of the mouse.

WE have received the report of the Bristol Museum and Art Gallery Committee for the year ending September 30 last, and congratulate the committee and the director on a year of steady progress in all departments. New cases have been provided for the birds, reptiles, amphibians, and fishes, and these groups of vertebrates have been completely re-arranged and placed in their natural place relative to the collections of invertebrates so well exhibited in the Dame Emily Smyth room, opened last year. This work completes the re-organisation of the zoological galleries, which must now rank as some of the most attractive in the provinces. A scheme for the reorganisation of the geological and mineralogical collections has been prepared, but cannot be carried out in its entirety until new cases are provided. We hope that the appeal made in this report will meet with an adequate response, for the collections contain much valuable material, *e.g.*, the series of Coal Measure fossils from the Bristol and Somerset coal beds, which, as pointed out in this report, is most complete, and must, for some time, remain unique owing to many of the mines having been closed down since they were collected. It is gratifying to note the increased use which has been made of the museum by students and by teachers and pupils of schools. The committee is alive to the educational value of museums and art galleries, and it is a pleasure to record the success which has attended its efforts to make the institution a real educational asset to the city.

DR. FELIX OSWALD recently presented to the Royal Geographical Society an account of his journey last winter from the Victoria Nyanza to the Kisii highlands. His primary object was to ascertain the geological nature of the locality where Mr. D. B. Pigott, shortly before his unfortunate death while hunting, found a jaw-bone of Dinotherium. Dr. Oswald, however, also investigated considerable areas of unmapped country in the Kavirondo and Kisii districts, and reconnoitred in the extensive tracts left uninhabited through the ravages of sleeping-sickness. He has also carefully studied the natives of the country east of the Victoria Nyanza, and made many references to the beautiful flora of the region. He drew a comparison between the successful ruling of this large and recently hostile country by a handful of Englishmen with the domination of the Romans in Britain, and described with welcome appreciation the way in which the land is governed by the district commissioner, two officers and a doctor, living at Kisii, which was chosen as the administrative centre as being outside the range of the tsetse-fly. Dr. Oswald has brought back collections of fossils, Neolithic implements, insects, shells, and certain plants, besides geological and topographical maps, and photographs—all as the result of only two months' work in the field.

IF from the vertices of a triangle perpendiculars be drawn on a straight line, and if from their feet perpendiculars be drawn on the opposite sides, these perpendiculars meet in a point called the orthopole. Mr. W. Gallatly has published a short pamphlet on the properties of the orthopole, based partly on Prof. Neuberg's work and partly on his own. His address is 5 Hampton Place, St. Marychurch, Torquay.

MESSRS. B. G. TEUBNER, of Leipzig, have forwarded their new catalogue of works on mathematics and natural philosophy, comprising books issued by them in these departments between April, 1908, and July, 1912. The catalogue is beautifully got up, and contains portraits of Leonard Euler as well as of the principal contributors to the Mathematical Encyclopædia and other publications.

THE use of algebraic formulæ for indicating the prices of goods in an actual price list appears to be somewhat of an innovation, but it has been introduced into the new catalogue of spectroscopic apparatus issued by Messrs. Adam Hilger, Ltd., of 75A Camden Road. A feature of greater importance is the excellence of the descriptions and illustrations of the apparatus with which the catalogue deals.

SUPPLEMENT No. 25, vol. xi., of the Communications from the Physical Laboratory at Leyden (this supplement being a reprint of article V. 10 of the *Encyklopädie der Mathematischen Wissenschaften*), by Prof. H. Kamerlingh Onnes and Dr. W. H. Keesom, consists of a most elaborate and extensive monograph on the equation of state. Together with its exhaustive references to the original literature, its table of contents and its author and subject indexes, this monograph forms a most valuable addition to science, and will be heartily welcomed by all workers in physics and physical chemistry. Prof. Kamerlingh Onnes is the recognised authority in this field of investigation, a position which he has won by thirty years of continuous and systematic theoretical and experimental work. It would be natural, therefore, to expect that this volume (extending to nearly 350 pages) would contain a masterly treatment of the subject, and it may be said at once that an examination of its contents more than justifies the expectation. The subject is discussed from every possible aspect, and includes a very full treatment of the theoretical as well as the experimental side of the problem. For many years to come the present monograph will be an indispensable work of reference for every physicist and chemist. We have also received Communications Nos. 127, 130, and Supplement No. 25 to Communications Nos. 121–132. These deal with researches on the isotherms of diatomic gases and their binary mixtures, on the second virial coefficient for diatomic gases, and on the Hall effect and changes in resistance in metals and alloys at low temperatures.

AN article on "The Essential Oils," including an account of the materials and methods of perfumery,

is contributed to *Knowledge* for December by Mr. H. F. Slack. Written in a popular style, it still contains a large array of accurate technical information, which will provide profitable reading for the trained chemist as well as for the lay reader.

UNDER the unassuming title of "Studies of Chinese Wood Oil, β-Elaeostearic Acid," Dr. R. S. Morrell describes in the Chemical Society's Journal a series of experiments which represent the starting-point of a new era in the study of "drying oils." This particular oil, when exposed to light, deposits a crystalline glyceride $(C_{18}H_{31}O_2)_3C_3H_5$, which absorbs oxygen with extreme facility, and possesses all the essential properties of a drying oil. But on account of its high melting-point, 61–62° C., it can be separated in a state of chemical purity, and provides for the first time a homogeneous material for the accurate scientific study of the "drying" process. The free acid of the glyceride and five of its salts are described in the paper. It is a remarkable fact that the ethyl ester, unlike the glyceride, does not possess the property of setting.

EXCEPTIONAL interest attaches to Prof. Kipping's papers on organic derivatives of silicon, issued in the November number of the Chemical Society's Journal. The most recent papers deal with silicane-diols of the type $SiX_2(OH)_2$. These compounds possess in a remarkable degree the property of forming anhydrides. Thus diphenylsilicanediol, $SiPh_2(OH)_2$, gives compounds such as the diols—

$$HO.SiPh_2.O.SiPh_2.OH,$$
$$HO.SiPh_2.O.SiPh_2.O.SiPh_2.OH,$$

and the oxides—

$$O\langle{}^{SiPh_2.O}_{SiPh_2.O}\rangle SiPh_2 \text{ and } O\langle{}^{SiPh_2.O.SiPh_2}_{SiPh_2.O.SiPh_2}\rangle O.$$

These are formed by the removal of water from two, three, three and four molecules of the original diol. Such compounds are undoubtedly typical of a tendency amongst silicon compounds to form chains and rings of alternate silicon and oxygen atoms, which are nearly as stable as the "all-carbon" chains of organic chemistry. This tendency serves to explain the prolific character of oxidised silicon, which gives rise to derivatives only less complex than the carbon-compounds of organic chemistry.

ON December 18 Mr. W. J. A. Butterfield delivered a lecture on coal gas before the Institute of Chemistry, at University College, London. The requirements of a public gas supply were first discussed, the principal points being minimum cost per heat unit, strong smell to facilitate detection of leaks, a luminous flame, and innocuous combustion products. The growth and magnitude of the gas industry here and abroad were then dealt with, the world's production of town gas in 1912 being estimated at 620,000 million cubic feet, for the production of which about 60 million tons of coal would be consumed. As by-products, 30 million tons of coke, 3 million tons of tar, together with ammoniacal products equivalent to about 550,000 tons of sulphate of ammonia, would be sold. As regards the annual consumption of gas per head of population, London heads the list with more than 8000 cubic feet. The predominant use of gas at the present day was stated to be for heating purposes. From this point of view present-day requirements of a gas supply in this country were characterised by (1) a gross calorific power of 540 to 580 B.T.U. per cubic foot; (2) specific gravity between 0·4 and 0·5; (3) oxygen required for complete combustion to be between 1·0 and 1·1 volumes of the coal gas, but the fluctuations in each of these to be restricted within narrow limits for any one district.

MESSRS. WILLIAMS AND NORGATE have just published the first number (January) of *The British Review*, with which is incorporated *The Oxford and Cambridge Review*. The aim is stated to be "to provide a periodical that shall be in the forefront of the world's movements, showing what there is to observe in mental and moral advancement." Among the articles in the January issue are:—"My Views regarding True and False Science," by Count Leo Tolstoy; "Bristol University and Some Reforms," by Mr. F. M. Atkinson; and "Huxley and the Catholic Faith," by Mr. Cecil Chesterton.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES FOR JANUARY:—

Jan. 5. 2h. 37m. Mercury in conjunction with the Moon (Mercury 5° 41′ N.).
,, 7h. 36m. Mars in conjunction with the Moon (Mars 4° 25′ N.).
,, 15h. 34m. Jupiter in conjunction with the Moon (Jupiter 5° 11′ N.).
8. 4h. 27m. Uranus in conjunction with the Moon (Uranus 4° 4′ N.).
9. 7h. 32m. Mercury in conjunction with Mars (Mercury 0° 47′ N.).
10. 22h. 29m. Venus in conjunction with the Moon (Venus 1° 28′ N.).
11. 3h. 4m. Mercury in conjunction with Jupiter (Mercury 0° 13′ S.).
13. 9h. 35m. Mars in conjunction with Jupiter (Mars 0° 47′ S.).
14. 20h. 0m. Neptune at opposition to the Sun.
17. 18h. 46m. Saturn in conjunction with the Moon (Saturn 6° 14′ S.).
21. 14h. 7m. Neptune in conjunction with the Moon (Neptune 5° 24′ S.).
23. 14h. 0m. Uranus in conjunction with the Sun.
28. 20h. 0m. Saturn stationary.
31. 19h. 30m. Mercury in conjunction with Uranus (Mercury 1° 23′ S.).

A BRIGHT METEOR REPORTED.—Two correspondents of *The Daily Dispatch* (December 21) report the appearance of what was probably a meteor of exceptional brilliancy at 10.50 p.m. on December 18. One describes it as a long, brilliant, bluish light, "about thirty yards long," and tapering to the "tail," around which was a peculiar pale golden glow. Stationed at Handforth, a village about nine miles due south of Manchester, this observer saw the meteor in the southern sky, and states that it appeared to fall slightly during its flight, which lasted eight seconds. The second observer states that the sky was so poor that no stars were visible from where he was, although the moon shone through the mist, yet the meteor was

so bright as to remind him of a great rocket. He describes it as a great white light, with a brilliant head and a long, spreading, and shimmering tail, which cut its way across the whole expanse of the sky. From his position in Manchester the meteor appeared to travel in a direction slightly north of west from a point not far from south. Further details of this phenomenon should prove of interest.

EPHEMERIS FOR GALE'S COMET, 1912*a*.—In No. 4618 of the *Astronomische Nachrichten*, Dr. Ebell publishes a daily ephemeris, extending to February 5, 1913, for Gale's comet. The comet is now high up in Draco, and is reported to have a nucleus of magnitude 10 or 11. The following is an extract from Dr. Ebell's ephemeris, which is based on the elements published in Lick Observatory Bulletin No. 218:—

Ephemeris 12 h. (M.T. Berlin).

1912–13	α (true) h. m.	δ (true) ° ′	log *r*	log Δ	Mag.
Dec. 27	17 17·6	+64 54·5	0·2245	0·1374	8·6
31	17 30·0	+68 14.8	0·2389	0·1426	8·6
Jan. 4	17 45·5	+71 34·9	0·2529	0·1490	8·8
8	18 5·9	+74 51·8	0·2663	0·1568	8·9
12	18 35·1	+78 1·0	0·2792	0·1661	9·0
16	19 20·1	+80 53·9	0·2917	0·1766	9·1

THE SPECTRUM OF NOVA GEMINORUM, NO. 2.—Having secured a number of photographs of the spectrum of Nova Geminorum, No. 2, Messrs. Adams and Kohlschutter give their measures and discussion of the radiations in No. 4, vol. xxxvi., of *The Astrophysical Journal*. The plates were taken with the Cassegrain spectrograph attached to the large reflector (80-foot focus) at Mount Wilson, and cover the period March 22–May 27. During this period considerable changes took place in the spectrum of the nova, and these are discussed at some length in the paper: the chief nebula line, λ 5007, was first certainly seen on April 6.

The authors have measured some hundreds of apparently dark and bright lines in the spectrum, and give observed wave-lengths for four groups of negatives, each group covering a definite period; thus in addition to the wave-lengths for the centres of the bright bands they give wave-lengths for the dark lines which some observers consider to be only parts of the structure phenomena of the bright bands. Generally speaking, the wave-lengths for the centres of the latter agree fairly well with those determined from the Madrid spectra, and published in NATURE on April 25 (No. 2217, vol. 89, p. 201), and, possibly, might bear the same interpretation. Ten wave-length values of bright bands are given as reasonably identified with helium lines, although it is somewhat difficult to see, from the list of observed wave-lengths, exactly the type of line, or band, some of them represent. The presence of radioactive substances in the nova's atmosphere is not indicated by the Mount Wilson photographs, and the authors consider that the presence of nitrogen, as suggested by Mr. Wright in the case of Nova Lacertæ, is probable but scarcely proven.

The widths and displacements of the bright and dark hydrogen lines are also discussed, and the paper is accompanied by reproductions of a number of excellent spectrograms.

OBSERVATIONS OF SATURN.—*L'Astronomie* for December contains the results of some observations of Saturn made by M. J. Camus, with the Mailhat equatorial of 0·19 m. aperture, at the French Astronomical Society's observatory, on November 7. M. Camus used a power of 230, and he reports that, in front of the planet, the exterior edge of the crape ring showed marked irregularities appearing in profile as grey patches on the yellowish background of the globe. He was also able to recognise the various tints of the same ring.

IMPROVEMENTS IN MICROSCOPES.

SOME time ago (NATURE, December 14, 1911) we referred to several improvements which Messrs. Beck had introduced into their microscopes, and we noted especially the "handle" model as one in which all risk of damage is avoided to the working parts and adjustments when the instrument is moved. Messrs. Beck now inform us that they have revised the make of their well-known "London microscope" on the handle model. In addition to this, the base and pillar are so designed that although the Continental model has been retained, the position of the centre of the inclining joint has been so placed as to give greater stability when the instrument is in a horizontal position, whilst not interfering with its vertical rigidity, and the size of the base has been increased to that of their large models to insure perfect steadiness under all conditions. The stage is square and specially large, measuring 4 in. in each direction. The coarse adjustment is by a spiral rack and pinion, so accurately fitted that even comparatively high powers can be focussed thereby. The fine adjustment is of the lever type. The adjustment is obtained by a fine micrometer screw actuating a supplementary pointed rod which impinges upon a hardened steel block working upon the lever. The body tube is 140 mm. long, with a graduated draw tube, in a carefully packed fitting, which extends to a length of 200 mm.

We have received a catalogue of microscopes from Messrs. W. Watson and Sons, 313 High Holborn, W.C., in which the well-known instruments manufactured by this firm are fully described. Their microscopes are British, both in design and construction, with the result that such points as a tripod foot to ensure rigidity in any position, and sprung fittings with adjusting screws to compensate for wear and tear, are insisted on. On the optical side, perhaps no firm has devoted more attention than Messrs. Watson to the substage condenser. In this connection it is noteworthy that they are now supplying an aplanatised Abbe illuminator, which has an aplanatic cone of 0·65 N.A., that is, 0·15 N.A. in excess of the ordinary type, its total N.A. being 1·20. At the price of 17*s.* 6*d.* such an appliance is obtainable by all microscopists, and will substantially increase the utility of any optical combination. It is interesting to see that such an improvement in substage illuminators is called for; at least it is reasonable to infer that such a demand has arisen. If it indicates that the average microscopist is at last awaking to the fact that in this direction he has the power greatly to increase the possibilities of his instrument, even if it is of a simple form, then there is much hope in the future for microscopy.

There is another matter of interest referred to in the catalogue. Messrs. Watson are now providing, under the designation *1/12 in., an objective which is really a 1/14 in. They state that many of the 1/12 in. lenses produced by other makers have really the magnification of a 1/14 in., so they determined to supply objectives of similar power. Tested with a Reichert 1/12 and a Leitz 1/16, the magnification of the new lens is half-way between the two. Its N.A. 1·30 and its wonderful definition enable it to resolve difficult test objects. The dots of *Surirella gemma*, for instance, are easily seen with oblique illumination, and the definition is good enough to

allow them to be seen, as dots, under a magnification of more than 3000. The colour correction leaves little to be desired, Carpenter's deal test has been applied, but no more than a very feeble trace of colour has been seen in any of the rings. This lens will be a valuable addition to a battery of objectives, and when its actual magnification is taken into account accurate statements of the actual power used can be made.

PRIZE AWARDS OF THE PARIS ACADEMY OF SCIENCES.

THE president of the Paris Academy of Sciences has announced the prizes awarded for the year 1912 as follows:—

Geometry.—Grand prize of the mathematical sciences divided between Pierre Boutroux (3000 francs), Jean Chazy (2000 francs), and René Garnier (2000 francs); the Francœur prize to Émile Lemoine, for the whole of his mathematical works; the Poncelet prize to Edmond Maillet.

Mechanics.—The Montyon prize to Ad. Doutre, for his inventions in connection with the stability of aëroplanes; the Fourneyron prize between G. Eiffel (1000 francs), for his experiments on the resistance of the air, and Armand de Gramont (700 francs), for his books on aërodynamics; the Boileau prize to A. Lafay, for his experimental studies on various problems concerning the action of the wind on solid bodies.

Navigation.—The extraordinary prize for the Navy between M. Le Page (2000 francs), Captain Ronarch (2000 francs), and M. Marbec (2000 francs); the Plumey prize between Victor Garnier (2000 francs), for his invention of a periscope for use in submarine navigation, and Henri Fabre (2000 francs), for his studies on the hydroaëroplane.

Astronomy.—The Lalande prize between H. Kobold and C. W. Wirtz, for their work on the determination of the motion of nebulæ; the Valz prize to A. Schaumasse, for his observations on comets; the Janssen medal (astronomy) to M. Perot, for the application of interference methods to the study of the solar spectrum; the Pierre Guzman prize was not awarded.

Geography.—The Tchihatchef prize to the Duke of the Abruzzi, for the results obtained in his expedition to the Himalayas; the Binoux prize to M. Fichot, for his geodesic researches; the Delalande-Guérineau prize to Captain Tilho, for his geographical work in Central Africa; the Gay prize was not awarded, but Lieut.-Col. Delauney receives an honourable mention.

Physics.—The Hébert prize to M. Houllevigue, for his researches in magnetism and thermoelectricity; the Hughes prizes to Arnaud de Gramont, for his spectroscopic work; the La Caze prize to Marcel Brillouin, for the whole of his researches in physics.

Chemistry.—The Jecker prize to M. Bourquelot, for his work on the chemistry of plants and plant ferments; the Montyon prize (unhealthy trades) to Paul Adam, for his work on the reduction of nuisance in the manufacture of superphosphate and his improvements in the storage of petrol and other dangerously inflammable liquids; the Cahours prize between Mme. Ramart-Lucas, Paul Clausmann, and M. Ostwald; the La Caze prize (chemistry) to M. Urbain, for his researches on the rare earths.

Mineralogy and Geology.—The Victor Paulin prize to Henri Arsandaux, for his chemical and petrographical work on silicate rocks.

Botany.—The Desmazières prize to Élie and Emile Marchal, for their work on mosses; the Montagne prize between Mme. Paul Lemoine (1000 francs) and H. Collin (500 francs); the de Coïncy prize to Camille Servettaz, for his monograph on the Eleagnaceæ.

Anatomy and Zoology.—The Da Gama Machado prize to J. Duesberg, for work relating to spermatogenesis of mammals; the Thore prize to Antoine Grouvelle, for his work on the Coleoptera; the Savigny prize to Louis German, for his researches on the malacological fauna of tropical Africa.

Medicine and Surgery.—Montyon prizes (2500 francs each) to V. Pachon, for his memoirs relating to the measurement of arterial pressure in man, Charles Nicolle, for his work on exanthematic typhoid, and O. Josué, for his researches on arterio-sclerosis; mentions (1500 francs each) are accorded to H. Carré, M. Mathis and M. Léger, and Étienne Ginestous; citations are accorded to Jean Troisier, Henri Claude and Stephen Chauvet, Albert Sézary, A. Magitot, Louis Renon, Noël Fiessinger, Georges Schreiber; the Barbier prize to Eugène Léger, for his pharmacological researches; the Breant prize was not awarded, but the arrears of interest were divided between C. J. Finlay (2500 francs) and A. Agramonte (2500 francs), for their work on the relation of mosquitoes to the propagation of yellow fever; the Godard prize to Jacques Parisot, for his work on the functions of the kidney and the suprarenal capsules; the Baron Larrey prize to Dr. Troussaint, for his memoir on the direction of the sanitary service in war, very honourable mentions being accorded to Ch. Teissier, M. Talon, R. Pigache and M. Worms, A. Conor; the Bellion prize to Mme. Banda-Legrain, for her work against alcoholism, J. Cavaillé receiving an honourable mention; the Mège prize is not awarded, the arrears of interest being given to Mme. Long-Landry, for her researches on Little's disease.

Physiology.—A Montyon prize (experimental physiology) to Paul Portier, for his studies on the digestive zymases, very honourable mentions being accorded to Max Kollmann, Théodore Rosset, and Jules Glover; the Philipeaux prize divided between E. F. Terroine and Marcel Lisbonne; the La Caze prize (physiology) to E. Wertheimer, for the whole of his work in physiology; the Martin-Damourette prize to Maurice Arthus, for his researches on the physiology of snake poisons; the Lallemand prize between Gabriel Petit and Léon Marchand, for their memoir on the comparative pathology of the nervous system, and Giuseppe Sterzi, for his work on the nervous system of the vertebrates; the Pourat prize to F. Maignon, for his experiments on the function of albumen as a food.

Statistics.—A Montyon prize (statistics) between Henri Auterbe (800 francs), Louis de Goy (600 francs), M. Janselme and M. Barré (300 francs), and Broquin Lacombe (300 francs).

History of the Sciences.—The Binoux prize to J. L. Heiberg, for his works on the history of mathematics; an additional prize (1000 francs) to Marcel Landrieux, for his book on the life and work of Lamarck.

General Prizes.—The Arago medal to Prince Roland Bonaparte; Berthelot medals to M. Bourquelot, Paul Adam, M. Clausmann, M. Ostwald, and Mme. Ramart-Lucas; the Gegner prize (400 francs) to J. H. Fabre; the Lannelongue prize between Mme. Cusco and Mme. Rück; the Gustave Roux prize to Armand Billard; the Trémont prize to Charles Frémont; the Wilde prize to M. Ferrié, for his work in the development of wireless telegraphy; the Lonchampt prize between M. Grimbert (2000 francs), M. Bagros (1000 francs), and Jules Wolff (1000 francs); the Saintour prize to Maurice Langeron (with 2000 francs), and a mention (with 1000 francs) to Will Darvillé; the Bordon prize is not awarded, but R. Robinson receives an encouragement (2000 francs); the Houllevigue prize between Henri Lebesgue (3000 francs) and M.

Taveau (2000 francs); the Caméré prize to M. Gisclard; the Jerome Ponti prize to Georges Rouy, for his researches in systematic botany; the Leconte prize between Charles Tellier (8000 francs) and M. Forest (12,000 francs); the prize founded by Mme. la Marquise de Laplace to Jules Adolphe Menj; the prize founded by M. Félix Rivot between J. A. Menj, J F. G. Daval, R. G. R. Mabilleau, and R. E. Bollack.

THE TIN MINES OF NEW SOUTH WALES.[1]

THE more rapid growth of the demand for tin than of the supply, and the disappointing failure of aluminium to replace tin for many purposes for which it was hoped to prove an efficient substitute, have led to the more careful study of the tin fields of the world and to an increase in the tin production by about a third in the first decade of this century. Mr. J. E. Carne has added a monograph on the tin mines of New South Wales to the series of valuable monographs with which he has enriched the economic geology of Australia.

The monograph is careful and exhaustive, and shows the author's combined caution and insight. It consists mostly of detailed descriptions of the tin mines and mining fields, and the economic problems naturally receive greater attention than the theoretical. There is, however, an interesting discussion of the genesis of tin ores, and the account of the mines is often enriched with suggestions of general interest. Economic questions are especially important in connection with a metal which is subject to such violent fluctuations in value, for the price of tin on the London market has varied since 1905 between 120*l.* and its present price of 230*l.* per ton. The association of tin with pegmatite veins has led to its being often claimed as one of the metals most likely to be of direct igneous origin; but Mr. Carne rejects the view that the tin in some granites was a primary constituent of the granite, and has been collected into veins as a direct differentiation product. He lays stress on the evidence which points to the deposition of the tin after the complete consolidation of the granite.

The New South Wales tin deposits are, however, not of the kind for which there is most to be said for the igneous theory. Mr. Carne gives a list of seventy-seven tin veins in New South Wales, and in sixty-nine of these the tin is associated with quartz, in twenty-nine with chlorite, in twenty with felspar, and in only three with tourmaline. The rarity of the association with tourmaline suggests that tin in New South Wales is not a pneumatolytic product.

The first record of tin in Australia which Mr. Carne accepts as authentic was in 1824. Actual tin-mining in New South Wales only began in 1872. Since 1875 the largest field—Emmaville—has yielded about 52,000 tons, and the Tingha field has yielded slightly less (45,500 tons). The tin mines in New South Wales include both alluvial deposits and lodes. The lodes belong to a type in which the distribution of the tin is sporadic and the patches of ore become smaller and poorer in depth. The deepest tin mine in Australia is the Vulcan Mine in North Queensland, which has already attained the depth of 1400 ft. The deepest in New South Wales is only 360 ft., and Mr. Carne's account of the lodes renders this fact not surprising.

J. W. G.

[1] "The Tin-mining Industry and the Distribution of Tin Ores in New South Wales." By J. E. Carne. (New South Wales Department of Mines, Geological Survey, Mineral Resources No. 14.) Pp. 378+xxxiii plates+8 figs.+14 maps and sections+iii maps in portfolio. (Sydney, 1911.)

OSMOTIC PRESSURE AND THE THEORY OF SOLUTIONS.

ATTENTION may be directed to a paper by Prof. A. Findlay on osmotic pressure and the theory of solutions, which has recently been published in *Scientia*. It has sometimes been suggested that the problems of osmotic pressure were solved once for all by van't Hoff's discovery that the gas equation $PV=RT$ could be applied to solutions by substituting "osmotic pressure" for "gas pressure." But the recent exact measurements of the Earl of Berkeley and Mr. Hartley in England and of Morse and his colleagues in America have shown clearly that this simple equation is so restricted that it cannot in practice be applied with any approach to accuracy in the case of any of those solutions of which the osmotic pressures have been exactly measured.

As Prof. Findlay points out, the first limitation to the equation $PV=RT$, when applied to solutions, is that the method used in deducing it only holds good for very dilute solutions. For stronger solutions the equation $P=\frac{RT}{V}=\frac{RT}{V_0}x$ becomes

$$P=\frac{RT}{V_0}\left\{-\log_e(1-x)\right\}=\frac{RT}{V}\left\{x+\tfrac{1}{2}x^2+\tfrac{1}{3}x^3, \&c.\right\}$$

where V_0 is the molecular volume of the solute and x is the molar ratio, *i.e.* the ratio of the number of molecules of solute to the total number of molecules present.

This equation assumes that there is no formation of complex molecules, no change of energy or volume on mixing the liquid solvent and solute, and that the solution is incompressible. G. N. Lewis has shown that it holds good in a marvellous way when applied to vapour pressure measurements in mixtures of propylene bromide and ethylene bromide at 85°. But even this equation fails to represent with any approach to accuracy the measured osmotic pressures of cane-sugar solutions. Better results are obtained by assuming the formation of a hydrate of the sugar, but it is abundantly clear that van't Hoff's equation is only the beginning and not the end of the quantitative study of osmotic pressure, and that direct measurements of this property are still of the highest importance in studying the theory of solutions.

ENGINEERING AT THE BRITISH ASSOCIATION.

A GLANCE at the proceedings of the Mechanical Science Section shows that a wide range of subjects was considered by the members, and, indeed, much planning was required to group the papers in such a way that all could be read and adequately discussed, and every moment of the available time was fully occupied in carrying out the longest programme of recent years.

In the course of his presidential address on the Thursday morning, Prof. Barr discussed the relation of the engineer to the public, both from a utilitarian and an æsthetic point of view, and by aid of many illustrations of modern engineering achievements he again and again enforced his main argument that the maintenance of a high ideal in all engineering work was necessary to obtain the highest good for the greatest number.

Such illustrations as the attainment of dustless roads, smokeless factories, ships, and locomotives, and the abandonment of all sham decoration of engineering structures gave point to an address which was free

from technicalities and permeated by a dry, literary humour of its own.

The address was followed by an important report, the fifth of the Gaseous Explosions Committee, which dealt chiefly with the radiation effects and the turbulent motion of the gas charge in the cylinders of internal combustion engines. In this account of a large amount of new work carried out by different members, the committee shows that turbulence plays a most important part in determining the time of ignition of the charge in high-speed engines, such as are now used for motor-cars and aeroplanes, while it also has a large effect on heat loss, although at very high explosion temperatures the radiation effect is of chief importance.

In connection with this paper Prof. Harold Dixon confirmed some of the results of the committee's work in his account of the experiments on coal dust explosions at Eskmeals conducted for the Home Office.

Prof. Thornton also described his experiments on the igniton of gaseous mixtures by momentary arcs, and indicated the safe limits for operating electrical machinery in coal mines containing inflammable gases.

An important discussion with Section A on wireless telegraphy commenced the proceedings on the Friday morning. This joint meeting afforded an animated discussion in which a number of speakers representing both sections took part. A summary of the chief matters of interest has already appeared in these columns (December 12, p. 421), and it only remains to mention that this meeting was the most successful joint gathering of these sections in recent years.

A paper immediately following, by Dr. Eccles and Mr. A. J. Makower, dealt with the production of electrical oscillations with spark-gaps immersed in running liquids. Although it appears that the efficiencies are about the same as that of an ordinary spark-gap in air, yet the former have the advantage of being practically noiseless, a matter of some importance in large-powered wireless stations.

The impedance of telephone receivers was also discussed in a paper by Profs. Kennelly and Pierce, and the effect of the motion of the diaphragm was analysed in some detail.

Another electrical paper of great interest was contributed by Prof. J. T. Morris, who described a method of measuring wind velocities by the aid of a small bare wire Wheatstone bridge having arms of manganin and platinum. The cooling effect of a current of air has no influence on the resistance of the manganin, but it lowers the resistance of the platinum, and an increased current is therefore required to effect a balance. This change of current is a measure of the velocity of flow of the air, as the author demonstrated by lecture experiments.

A discussion on the gas turbine, at the commencement of the Monday meeting, was opened by Dr. Dugald Clerk, who described the attempts which have been made in recent years to construct a successful gas turbine. In particular, the performance of the large turbine recently constructed by Herr Hans Hobzwarth was analysed in some detail. Unfortunately, Herr Hobzwarth was, at the last moment, prevented from attending the discussion, and the details of his latest improvements were not available.

An interesting group of papers dealing with motor-car and aviation problems was headed by a contribution from Sir John H. A. Macdonald, K.C.B., F.R.S., on "The Road Problem," in which he described the road-making methods of Macadam and Telford, and the modern attempts to obtain a dustless and practically indestructible road suitable for motor vehicles. Various interesting experiments on the acceleration and tractive power of motor-cars were described by Mr. Wimperis, who, in the absence of the author, Prof. Chatley, also gave a summary of a paper on the control of aeroplanes. The results of experiments at the East London College on the distribution of pressure on inclined aerocurves were also described by Mr. A. P. Thurston.

A considerable portion of the sitting on the Tuesday was devoted to naval problems, and the first paper was a notable contribution on the suction between passing vessels by Prof. Gibson, of University College, Dundee, and Mr. Thompson, the engineer of the Dundee Harbour Trust. Numerous experiments were made with a fair-sized steam yacht, and a 30-foot motor-boat running on parallel courses at speeds of about six knots, and these showed that suction was considerable, and rapid in action at lateral distances of less than 100 feet.

Prof. Henderson discussed problems in propulsion by the aid of energy systems moving with the propelled body, and Mr. Mavor described some large new vessels fitted with his system of electrical transmission, and showed the advances made since his paper of last year.

Mr. Axel Welin also described his system of lifeboat lowering and raising gear, which is now being fitted to numerous passenger vessels.

Papers relating to the testing of materials were taken on the concluding morning.

Prof. Coker described some optical determinations of the distribution of stress in plate and coiled springs, and also the results of stress determinations by thermo-electric methods. These latter have an advantage in that they depend on the sum of the principal stresses at a point, while optical measurements determine the difference, and a combination of both methods was advocated in certain cases.

Mr. Haigh described an ingenious electro-magnetic machine for obtaining repetitions of stress at frequencies up to 120 per second, and Mr. Larard showed some very fine kinematograph films of the fracture of torsion specimens.

Papers by Prof. Petavel and Dr. Lander were also read during the meeting, describing experiments on heat transmission, in which attention was directed to the large convection losses of steam-pipe coverings.

Mr. R. S. Whipple described a Féry bomb calorimeter in which the rise of temperature due to combustion is measured by thermo-couples, and the heating effect is absorbed by the metal, no water being employed.

Dr. Gray and Mr. Burnside gave an interesting demonstration of their motor gyroscopes, and Prof. Wilson gave an account of some exposure tests of aluminium alloys, while Dr. Wall discussed the question of hysteresis loss in iron due to pulsating and rotating magnetic fields.

Mr. T. Reid described a new form of rescue apparatus for coal mines, and Dr. Owens contributed a paper on the weathering of Portland stone.

The section was well attended throughout, and the discussions were well sustained. During the proceedings the section heartily congratulated Sir William White, K.C.B., F.R.S., a past-president of the section, on his election to the presidency of the Association for the Birmingham meeting next year. It is interesting to recall that in the last twenty-five years two other distinguished engineers, Sir Frederick Bramwal and Sir Douglas Galton, have filled the presidential chair.

E. G. C.

LORD LISTER.[1]

Introductory Remarks.

IT is said that the Egyptian kings, after death, had to undergo a trial before they were embalmed. Our great men appear to be similarly arraigned, as their character and attainments are brought to judgment by the lesser ones of earth, who bear testimony concerning them, weighing them in their own balance, each to his entire satisfaction.

The reputation of the smaller great men may be affected by this judgment. The reputation of the truly great lies beyond the reach of blame or praise, and lives on in history after all those who have weighed them have been forgotten. Such was Lister.

Unlike the Egyptian kings, however, Lister was tried during life. His struggle with disease and with the mind of his fellow-men, though long and severe, was ultimately successful, and the great good achieved by the adoption of his methods was universally acknowledged. Whilst yet in the autumn of his life he was able to look on at the spread of the antiseptic system over ever-widening areas, and to rest in the consciousness that he had accomplished a great work for the good of mankind.

It would be out of place here to lay before you in their order the honours and titles showered upon Lister in the latter period of his life, or to refer to the impressive ceremony on the occasion of his funeral in the fane of the immortals—Westminster Abbey—save to remind you that, though the Abbey was open to receive his remains, the true man was shown in him when he directed that his body should be laid where his dust would mingle with the ashes of one he loved, and who had been his constant companion and helpmate during the most active portion of his life.

Lister's Early Days.
His Father, Joseph Jackson Lister.

Lister was blessed in his earlier days by excellent environment, well suited to one who was about to follow a scientific career.

His father, Joseph Jackson Lister, was a man of outstanding scientific merit. He left school at fourteen years of age, to assist his parent at the wine trade, in London, and though for many years closely tied down to business, he yet contrived, by early rising and otherwise, to gain free hours in which to supplement the education received at school, which, though sound, was insufficient for his needs. He was thus, in many respects, a self-taught man. He possessed extreme accuracy of thought, and was a most methodical worker, skilful with brush and pencil. As a microscopist he was the first to solve the problem of the achromatic lens, whilst many observations on zoophytes and ascidians were made by him—a paper on the former appearing in the Philosophical Transactions.

Here, then, was a man of grit, who left school at fourteen years of age to enter business in London, but who, by dint of his own exertion, found means to extend his scanty education, devoting what time he could to scientific pursuits with accuracy of thought and methodical work. Had it been in one's power to choose a father for Lister, one could not have chosen a man better suited to the purpose.

His Teachers and their Influence.

The influence of Sharpey upon young Lister was great. At University College he was guided by Sharpey to undertake important researches, which were continued by Lister after he had left London. Papers were written by him upon numerous physiological and histological subjects—such as the contractile tissue of the iris, an inquiry regarding the parts of the nervous system which regulate the contractions of the arteries, the cutaneous pigmentary system of the frog, the coagulation of the blood, the early stages of inflammation, &c. There also Graham aided him in the study of chemistry, and furnished his mind with a sound knowledge of its principles. In Edinburgh he studied under Syme, and became a great admirer of Syme's intellect and judgment, as well as of his skill as an operator. This intimacy ripened and lasted throughout the remainder of Syme's life.

All these men were the best he could have been educated under and associated with. The knowledge and experience gained from them admirably equipped him for the life of research which he was about to enter.

It is obviously impossible here to deal with all the periods of Lister's life, and therefore it has been deemed expedient to select one of these, and that the most vigorous of his career, when he evolved the theory of antiseptics, and when he had to defend his thesis.

Pre-Antiseptic Days.

In Lister's early surgical days in the Glasgow Royal Infirmary he encountered the same phenomena, which prevented the healing of wounds, in all hospitals throughout the world. Suppuration in wounds was the rule, and very profuse it generally was. Dressing of the wounds had to be done daily, and sometimes several times a day.

The handling of highly-inflamed wounds was a source of pain, and the dressing was anticipated by the patients with an apprehension akin to terror, especially as the exhausting process, with its accompanying high fever, reduced the resisting powers of the individual to a low ebb. The suppurative process invaded the deeper tissues, affecting the blood-vessels, and produced septic thrombosis, from which septic emboli were carried to distant parts. The effect of the dissemination of the septic material was soon shown in the high temperature, the violent rigours, the profuse sweats, the sweetish, sickening odour from the breath, the yellow cachexia, emaciation, and final delirium which all too frequently ended in death. Sometimes every patient in a ward who had a serious operation performed upon him would be swept away. The wards would then be emptied, lime-washed, well ventilated, and reopened, soon to be the scene of further pyæmic ravages.

All this was most depressing for the attendants, and many of the young student dressers had at times to retire to the restoring influences of the open air, and there debate within themselves whether it were physically possible for them to continue their work in the midst of such scenes of suffering.

Surgeons and patients alike dreaded operations, owing to their terrible results, and only operations of dire necessity were permitted to be performed. Severe compound fractures were treated by amputation of the limbs, as to attempt to save them was to court disaster. Consequently amputations in those days were common. It is impossible for students of the present day adequately to realise the conditions which previously existed.

Inflammation supposed to be necessary to Wound Healing.

Surgeons were ever at work, attempting to discover the cause of this excessive inflammation, and many were the theses and volumes written on the subject.

[1] From a discourse delivered at the Royal Institution on June 7, 1912, by Sir William Macewen, F.R.S.

It was fully recognised that, if one could discover the cause of this excessive inflammation, it would be the first step toward eradicating the serious conditions attending wound healing. The minds of men, however, were obscured by an initial error of fundamental importance, which warped their vision, and for which the doctrine inculcated at the time was responsible. The error lay in the belief that, with the exception of healing by what was known as primary union, inflammation was necessary for wound healing, and that in the process of healing the phenomena of inflammation were always present.

Wound healing was treated in the text-books under the heading of inflammation. So that, instead of inflammation being regarded, *ab initio*, as a noxious process, it was looked upon as a necessary and beneficent one. It was only when it became excessive that it was regarded as baneful, and efforts were made to lessen it.

The trend of inquiry was therefore directed toward the elucidation of the phenomena produced by inflammation on the tissues, instead of endeavouring to discover the cause of inflammation and how it could be prevented.

Saviotti and Lister on the Nerve Control on the Blood-vessels in the Early Stages of Inflammation.

Much time was devoted by many observers to the elucidation of the effect of reflex action upon the blood-vessels, in the early stage of inflammation. The investigations of Saviotti[2] and Lister proved that reflex action, to which alone active hyperæmia had been previously attributed, was not the only factor in the production of increased local blood supply. From observation on the cutaneous pigmentary cells of the frog, it was evident that they were controlled by reflex action, as exhibited when the pigment in them contracted to the centre of the cell, under the influence of a beam of light, passing through the eye of the animal. It was also seen that limited areas could be taken out of the control of this general reflex action, by the application of certain irritants applied locally.

In order to account for this latter phenomenon, it was deduced that peripheral nerve ganglia must exist, having control of limited areas, and that when these ganglia were paralysed, they would no longer transmit the general nerve impulses.

Granting this conclusion, it was further deduced that a similar local nerve control might regulate the smaller blood-vessels under topical irritation of the parts and in the earlier stages of inflammation. If these ganglia were paralysed, the arteries would dilate, as is seen in active hyperæmia.

These communications were interesting and important, yet, though highly appreciated by all who valued science for itself and admired it for the truth it aimed at, they did not directly appeal to those who look lightly upon investigations the results of which are not immediately productive of direct and tangible benefits.

Microbes Discovered to be the Cause of Putrefaction and Fermentation (Cagniard-Latour and Schwann).

While darkness still brooded over the realm of medicine and surgery, notwithstanding endeavours to reach the light, investigations had been conducted in quite other fields, which were not only important in themselves, but were destined to lead to the revelation of multitudes of hitherto invisible organisms, everywhere existing, and playing a very potent part in the economy of the world.

More than thirty years previously, 1835–37, Cagniard-Latour in papers to the French Academy[3] recognised that alcoholic fermentation was due to the presence of a living organism. He found that grape-juice contained numerous globular bodies which he considered to be of vegetable nature, and which reproduced themselves by budding. These were always present when fermentation occurred, and in their absence fermentation did not take place.

In the following year, Schwann, of Berlin,[4] published the results of an investigation into the causes of putrefaction, in the course of which he also independently discovered the yeast plant.

What was of equal importance, he demonstrated that a putrescible fluid, such as a decoction of meat, could be freely and indefinitely exposed to the action of pure air—air free from dust and organisms—without putrefaction ensuing in it.

Those views of Schwann that putrefaction is due to the action of living organisms, and those of Cagniard-Latour showing that fermentation is caused by the yeast plant, did not, for more than thirty years, yield the fruit which, viewed from present knowledge, might have been expected from them.

Cagniard-Latour and Schwann's Observations confirmed by Pasteur, 1858.

Pasteur, when in the University of Lille, had abundant opportunity of studying alcoholic fermentation, as alcohol was the staple article of manufacture in that town. He became thoroughly convinced of the correctness of the observations and deductions previously made by Schwann and by Cagniard-Latour. He verified and extended those observations showing that fermentation was due to micro-organisms, and confirmed the observations of Schwann that pure air had no effect in producing putrefaction.

An Organism found to be the Cause of a Disease by Davaine, 1850.

In 1858 Pasteur reasoned from analogy that the relation of micro-organisms to disease was highly probable, and that the changes taking place in the secretion of a wound were probably due to a somewhat similar process to that of fermentation. The probability of micro-organisms being the cause of disease was greatly increased by a momentous discovery from a totally different quarter, an organism having been constantly found invading the tissues and blood-vessels of animals which had died of splenic fever. This was the *Bacillus anthracis*, discovered by two observers, Davaine[5] and Rayer in 1850, though it was ten years later before the complete identification of the relationship of this germ to the disease was definitely established.

Chronologically this was the first pathogenic bacillus discovered.

Other Theories of Fermentation.

Those observations and conclusions of Schwann, Cagniard-Latour, Pasteur, and Davaine were not generally known, and, where known, were not generally accepted, other theories being still in the field.

Besides the chemical theory of fermentation and putrefaction, the believers in heterogeneous and spontaneous generation were still many. Pouchet,[6] in 1859, made a systematised attempt to prove the possibility of spontaneous generation, and even after the antiseptic theory had been formulated, spontaneous

[2] "Virchow Archiv," vol. i.

[3] *Annales de Chimie et de Physique*, t. lxviii., 2nd series, p. 206, 1838; *Comptes rendus*, t. iv., p. 905, 1837.

[4] *Poggendorff Annalen*, xli., p. 184, 1837.

[5] Davaine, "Recherches expérimentales sur la Maladie Charbonneuse," par H. Toussaint. (Paris: Asselin and Co.)

[6] Pouchet, "Hétérogénie ou Traité de la Génération spontanée basé sur des nouvelles expériences." (Paris, 1859.)

generation was still advanced by Bastian[7] and other observers, who tried to demonstrate that vital force and living matter may arise *de novo* under the action of ordinary physical forces.

Tyndall, Huxley, and Ray Lankester against Spontaneous Generation.

Such writings had the effect of confusing the issue and diverting men's minds from the truth, and it was in no small measure due to the powerful help of Tyndall, Huxley, and Ray Lankester that the error was conclusively refuted.

Dr. E. Ray Lankester (NATURE, January 30, 1870) stated that he had performed numerous experiments with turnip solution, made under the conditions given in Dr. Bastian's book. No life was developed, a result contrary to that obtained by Bastian.

Prof. Huxley (NATURE, October 13, 1871) stated that he had seen Dr. Bastian's experiments and preparations, and expressed his belief that the organisms which Bastian got out of his tubes were exactly those which he put into them.

Tyndall, the illustrious predecessor of Sir James Dewar at the Royal Institution, submitted the question to fresh investigations. He had gone over the ground on which Bastian took his stand and was able to expose many of the errors by which experimenters were misled. One very beautiful and convincing experiment was introduced by Tyndall. He observed the fact that in a box the sides of which were coated with glycerine, all the particles of dust floating in the inside air fell and adhered to the glycerine in the course of a few days. The air is then *optically* pure. A transmitted ray of light tells the moment when this purity is obtained. Tyndall proved that to an eye rendered sensitive by remaining in darkness for a few minutes, the course of the ray is visible only so long as there are floating particles of dust capable of reflecting or diffusing light. On the other hand, the course of the ray becomes invisible to the eye as soon as the air has deposited all its solid particles.

When this deposition has occurred, any organic infusion may be introduced into the box and kept there without undergoing the least putrefactive or fermentive change, and without producing bacteria.

Lister Promulgates and Introduces the Practice of the Antiseptic Treatment of Wounds.

While professor of surgery in Glasgow, Lister was constantly speculating on the cause of inflammation and the cause of putrefaction in wounds, and during a discussion with friends, it was suggested to him that Pasteur's papers on fermentation might be of use in elucidating what seemed to be somewhat kindred processes. These papers of Pasteur came as a revelation to Lister, especially as he had not been cognisant of the observations made about thirty years previously by Schultze (1836), Schwann (1837), and Cagniard-Latour (1838), which had really laid the foundation of the germ theory and modern bacteriology.

The perusal of Pasteur's work threw a flood of light on the subject of decomposition in wounds, and Lister at once accepted the theory, and began a search for a something which would prevent the entrance of living organisms into wounds, believing that if such were found the healing of a wound would proceed "just as if it were subcutaneous."

About this time creosote—the active agent of which was carbolic acid—was used for disinfecting sewage, and Lister secured a sample of carbolic acid from Dr. Anderson, professor of chemistry in Glasgow University. He tried it in August, 1865, with results which justified his hypothesis.

In the wards of the Glasgow Royal Infirmary, which, previously, in common with other hospitals, had been the home of septic diseases, with their terrible issues, the introduction of the antiseptic treatment by Lister acted like the magician's wand, dispelling the horrors which previously accompanied wound-healing and creating an atmosphere of sweetness and health.

Difficulties in Accepting Antiseptic Theory and Practice.

The new treatment and the theory on which it was founded were received at first—save by a few faithful pupils—with scepticism and coldness, and later on with open hostility.

Germs in purulent wound secretions were not then demonstrated, and Lister was boldly called upon to show those organisms in such secretion before founding a theory and practice upon the assumption of their presence. This desirable demonstration was not obtained until later (1880–81), when Billroth and Ogston demonstrated the presence of organisms in pus taken from acute abscesses. Yet the deduction arrived at by Lister at that time, from the experiments of many able and trustworthy men of science, was not only permissible, but was the only one to which the data then available inevitably pointed.

Subsequent investigations with which all are now conversant abundantly proved the correctness of the conclusion.

The usual fate meted out to innovators or disturbers of settled doctrines was shared by Lister. He and his theory were virulently assailed both from within the hospital and from without. Some colleagues, some governors, and a host of freelances all joined in the fray, the most ignorant being ever the loudest. He was despitefully used, and had to bear the derision and cackle of fools. A scoffer has not necessarily a high standard of intelligence, and at best he does but devil's work. Fortunately such ephemera, troublesome and annoying as they are, die before the light.

Germany readily accepts Antiseptic Teaching.

Lister's teaching in this country was at first of no avail. It fell upon ears unprepared to receive it. Except by his own students in Scotland and a sprinkling of them in England, the antiseptic treatment passed unheeded over Britain, yea, even over the land of Pasteur it passed to other nations, especially to that country where the scientific education of its people, their earnestness of purpose, thoroughness of method, and their desire to see under the surface enable them to appraise quickly any theory and practice having a scientific basis.

Another reason for the rapid spread of antiseptics among the surgeons of northern Europe was that they bestirred themselves "to go and see" the practice first-hand. Thereafter they returned to their homes with a precise knowledge and a truer conception of the theory and practice than they otherwise could have had.

The influence of Danish and German testimony, corroborative of the value of the antiseptic treatment, made itself felt, and did much to render its adoption universal.

Pyogenic Organisms Discovered, 1880; Organisms the Cause of Disease.

The discovery of pyogenic organisms as the cause of suppuration in wounds was of great importance, as it demonstrated the correctness of Lister's theory and gave a tangible basis for the practice. It placed

[7] Bastian, "The Beginnings of Life," 1872; "The Evolution and Origin of Life."

both the ætiology of suppuration and its treatment upon a scientific basis. Empiricism was in great measure overthrown, and henceforward a rational ætiology for disease and its treatment was sought. Microbiology, then in its infancy, received a great impulse, and fresh fields were opened from which an ever-increasing harvest has been reaped. From the burning plains and pestilential swamps of the tropics, to our own slums, with their three great D's—dirt, damp, and darkness, which we fondly harbour in our midst—disease after disease has been traced to its micro-organismal cause. Those diseases which remain will doubtless yield their secret to steady investigation, and would do so all the more readily if submitted to a properly constructed investigation department under scientific control.

Tuberculosis, which for centuries was regarded as an hereditary disease, was shown to be germ-borne, common to man and to the lower animals, and to be intercommunicable between them. Cancer and sarcoma and the varieties included under these terms are doubtless also germ diseases, the germs of which are probably to be found near our everyday life, if our eyes were open to perceive them. The need of a scientific experimental investigation department under scientific control is all the more apparent as the Government has at last ventured to advance measures intended to mitigate one of the communicable diseases —tuberculosis.

Yet what the governing bodies do with the one hand they undo with the other.

For instance, in the old days the light that entered our houses was taxed, and the windows became smaller; to-day the powers that be tax the air contained therein, and for every cubic foot of air enclosed additional charge is made. In order to escape or to lessen this burdensome assessment, many huddle themselves and their families into dwellings of the smallest compass, where they inhale pre-breathed air, with the resultant lowering of vitality, germ-dissemination, disease, and death. Then we appoint commissions to find out the cause of the deterioration of the race!

Every man who is born has an inalienable right to as much fresh air as he is able to consume; but the "powers that be" say, "God may give you that right, but we shall tax you for using it." It is true that they do not as yet tax us for the amount of air we inhale out of doors, possibly because they do not know how to estimate the individual consumption. Yet the governing bodies are full of humanity and have the best intentions. When the ravages of tuberculosis can no longer be hidden, as it stares them in the face, they are moved to grasp at the first thing that appeals to them, and they say to the affected, "Come, let us help you; we shall put you in sanatoria." What happens there? The patient has his birthright restored to him in being able to breathe the fresh air which God has meted out so freely, and for the use of which he was previously taxed.

Would it not be better to begin at the other end?—better to stop producing tuberculosis than merely to alleviate or to cure it once it has developed?

Modifications in Antiseptic Treatment.

Antiseptic treatment underwent many modifications. What was essential in the early days of its introduction became no longer necessary as the advance of knowledge brought clearer conceptions and paved the way for radical changes in the form of treatment. It became apparent that though strong antiseptics introduced into wounds destroyed organisms, they at the same time exercised an irritating influence on the living tissue, lowering its vitality, decreasing its resisting power, and increasing its secretions. To that extent the free use of antiseptics in the interior of wounds was detrimental.

Besides being harmful, they were unnecessary, as healthy living tissue of the interior of the body is free from germs, and pure air is innocuous.

Evolution of Aseptic Treatment.

As microbiology yielded its secrets, the bearing of germs and their products on the phenomena of disease ever became the clearer. The primitive conception of germs acting upon the human body just as they would in a laboratory test-tube was soon dispelled, and the multiplicity of the defensive reactions established by the living tissues for their own protection was recognised. It was seen that the microbic products excited the tissues to anti-bacillary action, and the elements of immunity, as we now understand it, were established.

The anti-bacillary phagocytic action of the living healthy tissue was demonstrated by the beautiful experiments of Metchnikoff, when it was seen that a certain number of organisms, brought into contact with the living tissue, could be destroyed therein by living cells. It also became obvious that the healthy living tissue in the interior of the body was inherently free from germs, and when wounded was capable of healing rapidly, and would do so if its vitality were preserved, and if germs emanating either from the abundant flora of the skin or from elsewhere could be prevented from being brought into contact with it.

This was effected by sterilising the skin and the instruments and all material brought into contact with the wound, without allowing antiseptics to invade the interior of the tissues.

It is upon such lines that aseptic treatment was introduced. Aseptic surgery was a natural evolution of antiseptic surgery—the one paved the way for the other.

The surgery of the present day involves the performance of painless, almost bloodless, operations, the wounds healing, as a rule, under a single dressing of the slightest description. Any material introduced into a wound for the arrest of hæmorrhage, or for bringing the parts together, is of a kind which, after its function has been performed, the living cells are able to remove. When the patient recovers from the effects of the anæsthetic his trouble is over. The film which covers the wound drops off of itself as soon as the phagocytes have completed their work of removing the deep part of the catgut stitches.

The air of cheerfulness in a surgical ward is now pronounced, the difficulty often being to persuade the patients to remain quiet for a time sufficient to allow the internal parts to heal.

Advances consequent to the Introduction of Aseptic Surgery.

The introduction of aseptic surgery and the extension and more correct appreciation of bacteriological knowledge have enabled surgical procedures upon the human body to be greatly extended. The dangers arising from risk of wound infection being averted, many new devices have been practised for reaching the internal organs and for removing therefrom the products of disease.

Regions of the body hitherto considered too dangerous to be operated upon have now been successfully entered, and it soon became apparent that wherever diagnosis showed the presence of a serious pathological lesion, there the surgeon could follow, and where practicable eliminate it.

Since the introduction of asepsis and the conse-

quent acquisition of extended and more definite pathological knowledge, the field of greatest surgical activity has been the abdomen—abdominal surgery, as we now know it, has been created. Tens of thousands—possibly millions—of human lives have been saved in this field alone, and the amount of pain and discomfort alleviated has been enormous.

Surgeons of all countries have contributed to this beneficent result, and have vied one with another in restoring health and comfort to the community, thus adding greatly to the economic prosperity of the nations.

Compound fractures, so fatal in pre-Listerian days, were not only robbed of their fatality, but surgeons became emboldened to make compound fractures for the rectification of malformation of the limbs.

Compound fractures, under the heading of osteotomies, have been performed aseptically in thousands—the bones healing aseptically. A portion of bone which has been fractured and displaced may be removed, placed in aseptic solution, pared, rearranged, and returned to its proper place in the body, where it will live and grow, and become restored to its functional use. Defects in the bone of one person may be made up by grafting on a portion of bone removed from another. A transplanted bone may be divided into little pieces, and a mosaic work of new bone may be placed in another animal to restore defects.

Asepsis, along with better knowledge of the physics of the pleura, has enabled surgeons to penetrate into the lungs and to remove therefrom pathological products, with a gratifying amount of success. Portions of lung have been removed, and several times the whole of one lung has been successfully taken away—the patients still continuing to enjoy life, working for their own living and one, at least, for that of his family.

Aseptic surgery has enabled operations upon the brain to be safely undertaken, and brain surgery has kept pace with the localisation of cerebral function. Its further development rests with the increase of precise data on that subject. Direct experiment on the brains of lower animals furnished excellent data on the localisation of the motor functions, but information as to the localisation of the higher intellectual functions must be gathered by patient clinical observation.

The discerning eye and the discriminating sense guiding the educated finger with its softness and lightness of touch have, under asepsis, carried out many operative procedures on diseased brains, where the tangled skeins of that delicate fabric have been unravelled.

Considering the delicacy of the organ, and the fact that in many instances life has been sapped at the governing centres of energy by the pathological lesions, operations on the brain have been very successful, many of them veritably snatching the patient from the brink.

The consummation of all that surgical activity has been attained by the introduction of aseptic practice, surgery having been re-developed since the introduction of Listerian principles and treatment.

Personal Teaching and Demonstration versus *Books.*

It is fashionable nowadays to decry university teachers and professors, many regarding them as an effete remnant of antiquity. It is contended that all that is required is to issue a paper or a book and allow the students to read at their own firesides instead of compelling them to attend lectures and demonstrations in a university.

It is true that formerly the teaching extended only so far as the teacher's voice could carry, but now one can write in one's own laboratory, and, if the message be important, it will be borne to the limits of the civilised world, and thus it is possible to instruct an audience of unlimited size.

There is, however, a difference between teaching by books and *viva voce* teaching and demonstration. Some things may be explained by means of clear writing and may be understood by correct reading, but there are other things difficult of comprehension in detail without the aid of practical demonstration. More especially is this the case when one has not the opportunity of personal contact with the introducer or with one who has seen his practice and followed his methods. No matter how well a statement may be written, impressions are drawn from it which differ according to the preparedness and previous experience of the mind of each individual reader. Personal observation produces a much more vivid impression and generally corrects individual misconstruction.

As professor of surgery in Glasgow, Lister followed the Scottish method, teaching the principles of surgery in the University, and afterwards demonstrating his methods in the wards of the infirmary. His lectures in the University and his observations in the wards were complementary to each other, and gave a groundwork more thorough than could otherwise have been obtained. Those who had been so taught found his methods simple and easy of execution, and were often astonished at seeing others less fortunate falling into serious errors in their attempt to carry out the antiseptic practice after reading Lister's papers alone.

There were many earnest men—professors of Continental universities, amongst others—who were well qualified to read correctly what had been written, yet who, having read, were not satisfied, but straightway desired to be brought into personal contact with the professor, in order that they might hear his teaching from his own lips and see the practice carried out by his own hands.

Prof. Saxtorph, of Copenhagen, was amongst the first of the many distinguished visitors to the Glasgow Royal Infirmary to see Lister's practice and to study his methods. After a few days he remarked that the seeing of the practice persuaded him of its feasibility, and that it then seemed much easier than it did when he had only read Lister's papers. So it was with many others.

Lister as a Scottish and as a London Professor.

Lister's teaching was more rapidly propagated among the students he had in Scotland than among the London students. The position which he occupied as a Scottish professor aided in this, as it was different from that held by him as professor of surgery in a London hospital.

In London in those days, the bulk of students desired, naturally, to take the membership of the College of Surgeons, and most teachers at that time taught to the requirements of the Board of Examination, otherwise their prelections were not specially sought after. In London, Lister was teaching a new doctrine, not yet generally homologated, and his wards were attended by few students compared with the numbers that surrounded him in the Scottish universities. On the other hand, Lister had less time to devote to the teaching of students, as London was more accessible to foreign visitors, and many of his days were devoted to demonstrations for their benefit.

As a Scottish professor, Lister's position offered the greatest advantage for the dissemination of his doctrines. He could teach his own students what he

believed to be true, and, if necessary, teach them in advance of the time, as the teaching and the examination were both under his supervision. Hence Glasgow students were the first to become imbued with the spirit and to grasp thoroughly the principles of antiseptics, which they carried into practice. Scottish students thronged his wards and lecture-theatres in the infirmaries, an eager, critical, and ultimately an enthusiastic crowd, bringing inspiration to their teacher, whose principles and practice they afterwards bore to the ends of the earth, even before many examining boards were prepared to accept his teaching.

Lister's Influence on the Scottish Students.

Lister's presence in the Scottish universities was of the utmost value. By him teaching was maintained at a high level; he used the universities to stimulate thought, and therein aided them to perform their highest function. It was an inestimable blessing to a university to have such a man in it, and a priceless privilege to the students—to those of them who could appreciate it—to be allowed to stand silently by and watch the habit of mind and see how the brain worked. He was a man in earnest, and therefore he taught. His teaching was supported by direct appeal to nature. He accumulated data by observation and experiment, from both of which careful deductions were drawn. As a thinker, Lister did good by laying bare the difficulties he encountered in carrying out his projects, and his modes of overcoming these difficulties. In this way he stimulated and propagated the thinking faculties of the student. He showed his methods and thereby paved the way for others to follow.

In Glasgow Lister not only promulgated the theory of antiseptic surgery, but he worked out and thoroughly established its utility in practice, leaving behind him a body of enthusiastic disciples. After spending, as Regius professor of surgery, nine of the most active years of his life, and those fullest of scientific fruition, Lister passed quietly from Glasgow without public recognition of his services, the general body of citizens being unaware that a great scientific achievement had been wrought in their midst. It was long afterwards, when "all the world wondered," that Glasgow became alive to what it had possessed—and lost.

The Students' Appreciation of Lister.

As to the manner in which Lister was viewed by the Glasgow students, the following is an extract from a letter written me by a friend and fellow-student, which so well expresses my own views that I give it in his words:—

"We students were all very much impressed by the personality of Lister. His mild expression and his grave demeanour gave him benign dignity which could not fail to command respect. Even the impediment in his speech, which in another man might have been a source of annoyance to his hearers, seemed in his case only to add to the weight of what he said; and as he spoke slowly not a word of his lecture was lost. You remember how his students more or less unconsciously fell into a way of speaking which was a manifest echo of the master's voice. This affectation on the part of the students was simply an indication of the hero-worship which pervaded Lister's class, for there is no doubt we all idolised him.

"I understand it has been said of Lister that he was not a good lecturer, and that he was not a brilliant operator. You and I can laugh at such statements. Lister's lectures were all that could be desired. His subject-matter was always interesting—generally intensely so; his thoughts were clear and well defined, and he conveyed them to his hearers in choice and vivid language which left no doubt as to his meaning. As to his operating slowly, did he not tell us that the advent of anæsthesia by chloroform had rendered it unnecessary and undesirable to hurry through the work? Lister was thinking out and developing the antiseptic system at that time, and we were privileged to listen day by day as he informed us of his difficulties and how he proposed to overcome them; and so we watched the progress of those early stages which laid the foundation for the final triumph. . . . Above and beyond all petty details rises the towering personality of the man while the mind dwells fondly on the grandeur and beneficence of his achievements." (J. W. Allan.)

From another of Lister's Glasgow students, and one who was his house-surgeon in the Royal Infirmary, Dr. J. Coats (now Colonel Coats), who was among the first to practise antiseptic surgery in private, an interesting letter of reminiscences has been received, from which the following is culled:—

"One day when Lister was visiting his wards in the Glasgow Royal Infirmary, there was a little girl whose elbow-joint had been excised, and this had to be dressed daily. Lister undertook this dressing himself. The little creature bore the pain without complaint, and when finished she suddenly produced from under the clothes a dilapidated doll, one leg of which had burst, allowing the sawdust to escape. She handed the doll to Lister, who gravely examined it, then, asking for a needle and thread, he sat down and stitched the rent, and then returned the dolly to its gratified owner."

On one occasion on which Lister visited my wards in the Royal Infirmary, after he had been for some time in London, we were walking together from a ward in one part of the building to a ward in another, by means of a gangway of wood and glass, when Lister remarked: "Macewen, do you find this bridge a convenience to your work, for if so, you have to thank me, as I was instrumental in getting it put up?" I replied, "Yes, it is a convenience, but it is nothing compared to the greater gangway you provided, by which the patients after operation cross directly from the wards into the midst of life and health." I received a kindly look, a suppressed smile, and a pressure of the arm. . . .

In Edinburgh, though his system was met by some with determined opposition, it was adopted more or less thoroughly by others, and by many of the younger men enthusiastically. The students, though doubtful at first, began to observe his results, and soon became admirers of Lister and his work.

When Lister entered the clinical theatre of the old infirmary to deliver before a crowded audience his last lecture there, he was presented with a farewell address from the students. As he rose to reply, the air was rent with a rousing cheer that shook the building to its foundation. A cheer such as only British students—at rare moments—know how to give. It is spontaneous, and bursts like a blast from the throat of a whirlwind. Lister was fairly overcome. One who was near him, as a quiet observer, saw that he first became pale, and then a blush covered all his visible anatomy to the tips of his fingers. In a few moments he recovered, and said: "Gentlemen, I can recall my reception in the surgical theatre in Munich, on my visit to Nussbaum, where I was greeted with a German 'Hoch.' It was to me almost overpowering in its enthusiasm, but it was as nothing compared to this." (Dr. Young.)

That spontaneous outburst issuing from four hundred throats made amends for much. It was the laurel crown offered by the students. That rousing

cheer reverberated through his whole being, and left such deep impression as doubtless would be with him to the end.

In the evening of his long life, when he stood apart from the honours which had been showered upon him, there remained to him the greatest of all rewards, a clear conscience and the knowledge that he had devoted his life to and had achieved a great work for the good of humanity.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

DR. A. D. ROSS, lecturer on natural philosophy in the University of Glasgow, has been appointed to the chair of mathematics and physics in the University of Western Australia.

AT a special meeting of the council of Hartley University College, Southampton, held on December 30, Dr. Alexander Hill, late master of Downing College, Cambridge, was unanimously elected principal at a salary of 1000*l*. a year.

MR. FRANK ROSCOE, who for the past twelve years has been master of method in the Day Training College of the University of Birmingham, has been appointed secretary of the Teachers' Registration Council.

THE general meeting of the Association of Public School Science Masters will be held at the London Day Training College, Southampton Row, W.C., on January 8 and 9; in connection with the meeting Dr. T. P. Nunn will deliver a series of addresses on the afternoons of January 6 and 7, upon "The Theory of Science Teaching, with Special Reference to the Conditions in Boys' Schools." On Wednesday, January 8, the president of the association, Sir Archibald Geikie, K.C.B., P.R.S., will deliver an address, and there will be a discussion upon the aims and uses of school science societies. On January 9 the subjects to be discussed are:—Practical examinations in science, the teaching of mechanics, and the value of presenting the historical aspect in teaching science. A paper urging that the teaching of density should be placed in the background and be superseded by the idea of "Roomage," or specific volume, will be read by Mr. G. F. Daniell.

WE learn from *Science* that by the will of the late Prof. Morris Loeb, formerly professor of chemistry in the New York University, large bequests are made to scientific and educational institutions. Subject to the life interest of Mrs. Loeb, 100,000*l*. is bequeathed to Harvard University for the advancement of physics and chemistry, 5000*l*. is left to the American Chemical Society for the establishment of a type museum of chemicals, to be established in the Chemists' Club of New York City, the U.S. National Museum, or the American Museum of Natural History, and 500*l*. is bequeathed to the National Academy of Sciences. The Hebrew Technical Institute receives 10,000*l*. The residuary estate, subject to Mrs. Loeb's life interest, is to be divided equally among the Smithsonian Institution at Washington and certain New York institutions, including the American Museum of Natural History, the Hebrew Technical Institute, and the Educational Alliance. The Smithsonian Institution receives its bequest to further the exact sciences. The American Museum of Natural History is to secure a collection for the illustration of the industrial use of natural products in ancient and modern times. The Hebrew Technical Institute is to establish technical courses for mechanics.

THE report of the hundred and sixteenth session of the Royal Technical College, Glasgow, which used to be known as the Glasgow and West of Scotland Technical College, is a record of satisfactory progress. The number of day students for the session 1911–12 was 572; of evening students, 4691; and of students in affiliated continuation classes, 8682. The college is therefore the centre of an organisation responsible for the education of 13,945 individuals. The corresponding number for the preceding session was 13,473. The increase in the number of day students was twelve. The roll of students contained the names of 157 graduates of the four Scottish universities, and of the Universities of Oxford, Cambridge, London, Manchester, Durham, Leeds, Sydney, Adelaide, Calcutta, Allahabad, and Heidelberg. Although seven large laboratories were provided for pure and applied chemistry in the new buildings recently opened, they have already proved insufficient, and, in consequence, an additional chemical laboratory, to accommodate seventy-two students, has been provided by transferring to the corridors on the same floor the contents of the museum of technical chemistry. Such rapid development of an industrial department is good evidence that the college maintains its position as possessing one of the leading schools of applied chemistry. The new lectureship in sugar manufacture, founded with the aid of subscriptions from firms and individuals interested in this industry, has been established. Proposals have been made for the establishment of a lectureship dealing with leather-tanning, but the governors are obliged to postpone taking steps in this direction until subscriptions are forthcoming to meet at least one-half of the probable expense, as was done in the case of the lectureship in sugar manufacture. In other departments of the college there are similar developments, and the report makes it clear that under its new name this Scottish technical college is entering on a career of increased usefulness.

SOCIETIES AND ACADEMIES.

LONDON.

Linnean Society, Derember 19, 1912.—Prof. E. B. Poulton, F.R.S., president, in the chair.—Cecil H. **Hooper**: Experiments on the pollination of hardy fruits, with observations on the insect visitors to the blossoms. Strawberries, provided there is wind, set fruit well without insects. Raspberries and loganberries set fruit imperfect in shape if insects are excluded. Currants and gooseberries, owing to the construction of their flowers and pollen, cannot be pollinated and set their fruit without the visits of insects. All these plants set fruit perfectly with pollen of the same variety or even of the same flower; but in the case of the apple, pear, plum, and cherry, this is not always the case, many varieties being self-sterile, and almost all produce more abundant and finer fruit with pollen of another variety. In these trees there is little transference of pollen by the wind, and even if a self-fertile tree is enclosed in muslin whilst in blossom (there being ample movement of the wind, insects only being excluded), it is the exception for any fruit to set; it is the same with gooseberries and currants. In trials with apples, only nineteen varieties out of sixty-five proved self-fertile; in pears, four out of thirty; in plums, twenty-one out of forty-one; in cherries, five out of twelve; whilst, when cross-pollinated, in three-quarters of the trials one or more fruits set on a truss. There seems to be a preference as to pollen, some varieties setting better with pollen of one variety than with that of another;

and some varieties will not set with certain pollen. Out of nearly 3000 insects observed last spring visiting the blossoms of the various fruit bushes and trees, 88 per cent. were hive-bees, 5½ per cent. bumble and other wild bees, and 6½ per cent. flies, ants, beetles, wasps, and other insects; but the latter group have not fluffy bodies for carrying pollen, and amuse themselves eating the pollen.—H. M. **Chibber**: The morphology and histology of *Piper Betle*, Linn.

MANCHESTER.

Literary and Philosophical Society, November 26, 1912.—Prof. F. E. Weiss, president, in the chair.—Prof. F. E. **Weiss**: The root-apex and young root of Lyginodendron. This genus, one of the Coal-Measure plants, the remains of which are frequently preserved in the calcareous nodules of the Lancashire coal seams, is of peculiar interest, owing to the position assigned to it and allied genera. Fern-like in appearance, it is known to have borne seeds of considerable complexity, and it has therefore been placed in a newly established group of Pteridospermæ, between the true ferns and the flowering plants. As among other characters, these two groups are distinguished by the possession of a single cell or multiple group of such cells at the apex of their roots, an investigation of the root-tip of Lyginodendron is of some interest. Careful examination of numerous sections tends to prove that the structure of the root-tip of Lyginodendron agrees more closely with that of the ferns than that of the flowering plants.—Dr. Kurt **Loewenfeld**: The importance of autograph documents for the history of science (part ii.). The author dealt chiefly with letters by Priestley and Lavoisier. These included letters to Sir Joseph Bank and Josiah Wedgwood, and others relating to the Birmingham riots in 1791. The draft of a letter of the French chemists, offering to make good all Priestley's losses through the riots, was read. It is noteworthy, especially considering the scientific relations between Lavoisier and Priestley, that this draft had corrections by the hand of A. L. Lavoisier, which makes it evident that this letter originated from him.

DUBLIN.

Royal Dublin Society, December 17, 1912.—Prof. James Wilson in the chair.—J. **Adams**: The germination of the seeds of some dicotyledons. Investigations were made to determine how long the seeds of a particular species of plant remain in the ground before they germinate. Observations were made on 278 different species of plants belonging to 190 genera, and representing fifty-eight families. In some cases the seeds germinated after a few weeks, while in others, such as the hawthorn, a year and a half was required. The characters of 158 species not included in Lubbock's treatise are given. The majority of the seeds used were of British species, but a few exotic species, such as almond, fig, &c., were included.—Prof. T. **Johnson**: *Bothrodendron* (*Cyclostigma*) *Kiltorkense*, Haughton, sp. The paper treats of specimens obtained by the author at Kiltorkan, co. Kilkenny, and of others in the collections in Dublin and London. An attempt is made to prove that *B. Kiltorkense*, abundant at an epoch when Lepidodendron and Sigillaria were either non-existent or, if formed, still relatively rare, and showing pronounced calamitoid characters—including transverse zonation (nodal diaphragms?) and vertical fluting—is the earliest and best representative of the ancestral stock from which the Lycopodiales and Equisetales took their common origin.—Prof. J. **Joly**: A method of microscopic measurement. This is one which apparently has not hitherto been applied in microscopy; it consists in observing with the camera lucida the object to be measured, in such a manner that its image appears upon a sheet of paper on which two lines have been drawn slowly diverging from a point. By shifting the paper the image is made to fit exactly between the lines, the position where it fits being marked. A similar operation is performed with a suitably divided millimetre scale. From the data so obtained a simple calculation gives the diameter of the object.—Prof. H. H. **Dixon** and W. R. G. **Atkins**: Osmotic pressures in plants. (*a*) Methods of extracting sap from plant organs; (*b*) osmotic pressures and electrical conductivities of the saps of plant organs. (*a*) Various methods of obtaining sap for microscopic conductivity measurements are discussed. It is shown that the sap pressed from living tissues may have a concentration very different from that in the vacuoles of the cells, the protoplasm of which must be rendered permeable before the unaltered sap can be pressed. Exposure to heat, toluene vapour, or chloroform is open to objection. Treatment with liquid air seems free from objection, renders the membranes permeable, and allows the unaltered sap to escape. Cryoscopic and conductivity measurements on this true sap show that it is usually much more concentrated than that pressed from the untreated organs. An extreme example of this is afforded by the leaf of *Chamaerops humilis*. (*b*) The fundamental error in previous cryoscopic and conductivity measurements of the sap of plants, which was pointed out in the foregoing paper (*a*), renders revision of previous results necessary. The present paper contains a number of results of cryoscopic determinations, osmotic pressures resulting from them, and conductivity measurements made on saps obtained from organs treated with liquid air.

EDINBURGH.

Royal Society, December 16, 1912.—Prof. Bower, vice-president, in the chair. Irvine **Masson**: The precipitation of salts by corresponding acids. If B is the initial solubility in pure water, and *b* the solubility for acidity *a*, then within fairly wide limits it is found that the ratio $a/(B-b)$ is a constant, on which the change of temperature seems to have little effect. Its value is very nearly unity for the chlorides and nitrates experimented with. The main object of the paper was to connect by means of this empirical formula the two recognised methods for studying experimentally these relations, namely, the "solubility" method, which determines directly the solubility of a salt in water containing the acid in varying concentrations, and the "precipitation" method, as used by Gibson and Denison, which aims at ascertaining the minimum concentration of aqueous acid which when added in small quantities to the saturated aqueous salt solution causes deposition of salt. Prof. **Seward** and N. **Bancroft**: Jurassic plants from Cromarty and Sutherland. The material included Hugh Miller's collection in the Royal Scottish Museum, a section of a cone in Dr. Kidston's collection, petrified wood from Helmsdale lent by Dr. Horne, and two fossils found by Dr. Nathorst on the Sutherland coast. The examination of the material had led to the recognition of six new species, *Thinnfeldia scottica*, *Brachyphyllum eathiense*, *Masculostrobus Woodwardi*, *Conities Juddi*, *Cedroxylon Hornei*, and *Strobilites Milleri*. Prof. F. J. **Cole**: A monograph on the general morphology of Myxinoid fishes, based on a study of Myxine. Part V.—The anatomy of the gut and appendages. C Tate **Regan**: Antarctic fishes of the Scottish

National Antarctic Expedition. The fishes, which were collected in the vicinity of the South Orkneys, Falkland Islands, and Gough Island, include forty-eight species, of which ten are new to science. The report is supplemented with a monograph on the Notothenidæ and related families, a revision of the Qoarcidæ, and notes on the systematic position and distribution of the Galaxiidæ. It also includes an account of a new genus taken in South Georgia, and named *Chaenocephalus salveseni*. Prof. Émile **Topsent**: the Porifera of the Scottish National Antarctic Expedition. Several new genera and many new species are described from high southern latitudes and also from great depths.

PARIS.

Academy of Sciences, December 23, 1912.—M. Lippmann in the chair.—Gaston **Darboux**: Surfaces of translation.—G. **Lippmann**: An electric time-measuring apparatus for the comparison of two periodic phenomena. An arrangement of two electrical contacts on a tube rotating at a known uniform rate, and each separately adjustable, so that the time elapsing between the two contacts can be made any fraction of a second, read directly from the instrument. As examples of applications of the instrument are given the comparison of two sidereal clocks, the reception of Eiffel Tower signals, and the emission of time signals.—Th. **Schlœsing, Jun.**: The detection and estimation of free white phosphorus in phosphorus sesquisulphide. The method is based on extraction with a low boiling petroleum ether, and subsequent determination of the ratio of phosphorus to sulphur in the residue left after evaporating the ether.—M. **Gouy**: The spontaneously ionised gases. A reply to some criticisms by C. G. Darwin.—M. **Guntz** was elected a correspondant for the section of chemistry in the place of the late M. Cannizzaro, and M. **Lehmann** a correspondant in the section of mineralogy in the place of the late M. Zirkel.—Kr. **Birkeland**: The source of the electricity of the stars. A discussion of the possibility of the stars and the sun becoming negative by the loss of positive electrons.—E. **Belot**: The material of satellites with respect to the density of the planets, their time of rotation, and their superficial structure.—D. Th. **Egoroff**: The integration of functions.—N. **Lusin**: The properties of Denjoy's integral.—P. **Montel**: The existence of derived functions.—W. H. **Young**: Fourier's series convergent nearly throughout.—S. **Lattès**: The reduction of linear substitutions.—M. **Nörlund**: Linear equations with finite differences.—Witold **Jarkowski**: The equation of the barogram of the ascent of an aëroplane.—Jules **Roux**: The law of Stokes and the charge of an electron. A study of the fall of sulphur spheres of small radius in xylene and the application of Stokes's formula, modified by Cunningham, to the results.—M. **Jouguet**: The stability of equilibrium of a system enclosed in a cover impervious to heat.—E. **Briner** and E. L. **Durand**: The action of temperature on the equilibrium of nitric and nitrous acids, formed by starting with the oxides of nitrogen and water. An increase in the pressure of the NO and lowering of temperature both favour the formation of nitric acid.—Auguste **Piccard**: The constitution of water and the thermal variation of its magnetisation. On the assumption that any body has a constant diamagnetism so long as there is no change of state the temperature coefficient of magnetisation described in an earlier paper has been applied to determine the constitution of water. The results are in general agreement with those deduced from the change of density with temperature.—J. A. **Muller**: The mode of ionisation of sulphuric acid in dilute aqueous solution. A discussion of the experimental data given appears to show that in dilute aqueous solution sulphuric acid ionises into the ions H and HSO_4, and this ionisation takes place with evolution of heat within the limits of temperature studied.—M. **Hanriot**: Tempering of metals without deformation.—Marcel **Ostwald**: Some properties of the alkaline nitrites. A description of the mode of preparation of the pure nitrites, followed by data relating to the appearance, melting points, densities of solids and solutions of sodium and potassium nitrite.—Daniel **Berthelot** and Henry **Gaudechon**: The photolysis of various bioses and trioses by the ultra-violet rays.—Jacques **Duclaux**: The polymerisation of bodies at low temperatures.—Œchsner de **Coninck**: The determination of the atomic weight of uranium. The value 238·4 is derived from the ignition of the oxalate.—Léon **Guillet**: The copper-zinc-nickel alloys.—Léo **Vignon**: The fractional distillation of coal. Five samples of coal were heated successively to 400°, 600°, 850°, 1000°, and 1200° C., and analyses made of the gas given off at each temperature.—Maurice **Lanfry**: The action of hydrogen peroxide on oxythionaphthene, oxythionaphthene-carboxylic acid and thioindigo.—P. **Carré**: Contardi's glycerotriphosphoric acid. An adverse criticism of Contardi's results.—Marcel **Godchot** and Félix **Taboury**: The bromination of *cyclo*pentanone.—A. **Mailhe**: The nitro-derivatives of the oxide of meta-cresyl.—Georges **Tanret**: The presence of stachyose in the bean and in the seeds of some other Leguminosæ. Stachyose forms a strontium compound, and this was utilised in the detection of this sugar in various Leguminosæ.—G. **André**: The hydrolysis and displacement by water of the nitrogenous and mineral matters contained in leaves.—Marin **Molliard**: The hypertrophiant action of the products elaborated by *Rhizobium radicicola*. An account of comparative experiments on the growth of the pea in water and in water containing the secretory products of the above-named parasite.—L. **Armand**: Germination and development of the embryo in the Lobeliaceæ.—Pierre **Teissier** and Pierre Louis **Marie**: Attempts at variolic serotherapy.—J. **Renaut**: The direct connective filiation and development of arterial muscular cells.—Jacques **Mawas**: The form, direction, and mode of action of the ciliary muscle in man.—Jacques **Pellegrin**: New contribution to the ichthyological fauna of Lake Victoria (Africa).—A. **Magnan**: The functional adaptation of the intestine in ducks. A reduction in the length of the intestine has been obtained experimentally by change of food.—D. **Keilin**: The structure of the pharynx in the larvæ of some Diptera as affected by the nature of the food.—M. **Javillier**: The substitution of various chemical elements for zinc in the culture of *Sterigmatocystis nigra*. Cadmium is the only element analogous to zinc in its action on the growth of this fungus. The presence of a ten-millionth part of cadmium increases the yield 2·6 times.—Em. **Bourquelot** and H. **Hérissey**: The synthetical reaction between galactose and ethyl alcohol under the influence of kephir.—L. C. **Maillard**: The formation of humus and of mineral combustibles without the intervention of atmospheric oxygen, of micro-organisms, of high temperatures, or of strong pressures. The interaction of amino-acids with sugars gives brown condensation products containing nitrogen, and regarded by the author as analogous with the humus extracted from soil. Carbon dioxide is evolved in this reaction, which takes place in the absence of oxygen. This reaction is regarded as explaining the natural formation of humus.—Gabriel **Bertrand** and F. **Medigreceanu**: The temporary fixing and mode of elimination of manganese in the rabbit.—H. **Bierry** and Mme. Z. **Gruzewska**: A new method for the determination of glycogen in the liver. A modification of Pflüger's method, permitting more rapid estimations without loss of accuracy. Comparative figures are given for

results obtained by the proposed method and that of Pflüger.—Maurice **Nicloux**: An experiment realising the mechanism of the passage of carbon monoxide from the mother to the fœtus.—Ch. **Pussenot**: The middle Westphalian in the alpine axial zone.—G. Gouré de **Villemontée**: A case of globular lightning.—E. A. **Martel**: The displacement of the thermal springs at Roosevelt Dam, Arizona.

CALCUTTA.

Asiatic Society of Bengal, December 4, 1912.—Dr. Sten **Konow**: Fragments of a Buddhist work in the ancient Aryan language of Chinese Turkestan. This paper gives an account of six MSS. leaves (forming part of a bulky work containing about 400 leaves) recovered from Khotan, and written in verse in what is provisionally designated as the ancient Aryan language.—Dr. N. **Annandale**: Contributions to the biology of the Lake of Tiberias. No. 1, an account of the sponges. The paper is the first in a series based on a visit to Palestine made in October, 1912, with the object of discovering whether the peculiar fauna characteristic of fresh water in tropical Africa and Asia, especially as regards the lower invertebrates, extends northwards up the Jordan valley. Considered as a whole the sponge fauna of the lake provides evidence (1) that a peculiar fauna of closely related species is being evolved therein; (2) that in this lake, as in others, there is a tendency for the Spongillidæ to lose their characteristic gemmules; and (3) that as the gemmules disappear the skeleton of the sponges becomes harder and more compact.—D. **Hooper**: The Ash of the plantain (*Musa sapientum*, Linn.). The ash of plantain leaves and stalks is used in India for various industrial purposes: as a mordant in dyeing, as a soap, medicine, table salt, and manure. Analyses of authentic samples show a variation in composition and alkalinity, and do not exhibit a greater value than ashes of other plants. There is evidence that the composition of the ash is influenced by the soil in which the plants are grown.—M. H. **Sāstri**: A short note on Āyi Pantha, a newly discovered cult in the Bilāda District of the Mārwār State. The new religion was preached by women in the fifteenth century A.D. Its chief seat is at Bilāda in Mārwār. It has a perfect administrative organisation, and it has about a lac of adherents. The chief object of worship is a light kept up for the last 450 years fed by ghee. It emits no smoke, but a yellow substance called "Kesara," which means saffron. The lady preacher is known as "Āyi," and the cult is therefore called "Āyipantha." As Shams Tābrez is an object of reverence, this cult seems to be a survival of the ancient fire-worship of Irān.

BOOKS RECEIVED.

Handwörterbuch der Naturwissenschaften. Edited by E. Korschelt and others. Lief. 26 to 34. (Jena: G. Fischer.) Each 2.50 marks.

Beziehungen des Lebens zum Licht. By Dr. C. Neuberg. Pp. 63. (Berlin: Allgemeine Medizinische Verlagsanstalt G.m.b.H.) 1.50 marks.

The Moorlands of North-Eastern Yorkshire: their Natural History and Origin. By F. Elgee. Pp. xvi+361+illustrations+maps. (London and Hull: A. Brown and Sons, Ltd.) 12*s.* 6*d.* net.

The British Bird Book. Edited by F. B. Kirkman. Section x. Pp. 188+plates. (London and Edinburgh: T. C. and E. C. Jack.) 10*s.* 6*d.* net.

Notes on the Natural History of Hornsea Mere. By G. Bolam. (London and Hull: A. Brown and Sons, Ltd.) 1*s.*

Untersuchung und Nachweis organischer Farbstoffe auf spektroskopischem Wege. By Prof. J. Formánek. Zweite Auflage. Zweiter Teil. 2 Lief. Pp. 165–366+plates. (Berlin: J. Springer.) 14 marks.

Abrégé sur l'Hélice et la Résistance de l'Air. By M. Gandillot. Pp. 188. (Paris: Gauthier-Villars.) 10 francs.

Bergens Museums Aarbok, 1912. 2det Hefte. Pp. 84+plates xxvii+152+plate i. (Bergen: J. Griegs.)

Bergens Museums Skrifter. Ny Rœkke. Band ii., No. 1. Vestlandske Graver fra Jernalderen. By H. Schetelig. Pp. iii+242. (Bergen: J. Griegs.)

DIARY OF SOCIETIES.

FRIDAY, JANUARY 3.

GEOLOGISTS' ASSOCIATION, at 8.—Some Valleys and Moraines in the Bergen District, Norway: H. W. Monckton.

MONDAY, JANUARY 6.

ARISTOTELIAN SOCIETY, at 8.—Intuitional Thinking: Prof. Frank Granger.

SOCIETY OF CHEMICAL INDUSTRY, at 8.—The Estimation of Glyceryl Acetate in Essential Oils: S. Godfrey Hall and A. J. Harvey.—The Estimation of Moisture: F. H. Campbell.—The Determination of Moisture in Foods, etc.: W. P. Skertchly.—The Determination of Water: G. N. Huntly and J. H. Coste.

TUESDAY, JANUARY 7.

RÖNTGEN SOCIETY, at 8.15.—Spark Photographs at High Pressure: Prof. A. W. Porter, F.R.S., and W. B. Haines.—Some Relations between Kathode and Röntgen Rays: Dr. R. Whiddington.

WEDNESDAY, JANUARY 8.

GEOLOGICAL SOCIETY, at 8.—The Geological History of the Malay Peninsula: J. B. Scrivenor.—A Mass of Anhydrite in the Magnesian Limestone at Hartlepool: C. T. Trechmann.

THURSDAY, JANUARY 9.

CONCRETE INSTITUTE, at 7.30.—Concrete in its Legal Aspect: W. Valentine Ball.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—The Design of Apparatus for Improving the Power Factor of A. C. Systems: Prof. Miles Walker.

MATHEMATICAL SOCIETY, at 5.30.—The Reduction of Ideal Numbers: W. E. H. Berwick.—Proofs of Certain General Theorems Relating to Orders of Coincidence: J. C. Fields.

FRIDAY, JANUARY 10.

ROYAL ASTRONOMICAL SOCIETY, at 5.

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