THURSDAY, JULY 24, 1913.

CAMBRIDGE IN THE NINETEENTH CENTURY.

"J.": a Memoir of John Willis Clark. By A. E. Shipley. Pp. x+362. (London: Smith, Elder and Co., 1913.) Price 10*s.* 6*d.* net.

TO anyone who had a share in Cambridge life in the latter half of the century that closed with 1910, J. W. Clark, either as superintendent of museums or as registrary, was a familiar and striking figure. The many who knew him intimately called him "J.," and all will welcome the biography with that title which the Master of Christ's, in more ways than one "J.'s" successor, has produced with the assistance of a number of friends. The book itself is rather gossipy. "We respected him as a man of learning and weight, and still more as a man of the world," says one of the contributors; and it is largely with "J." as a man of the world that the book deals. From the point of view of the casual reader, it reminds one somehow of the hundred and nineteenth psalm. The kaleidoscope is shaken through some 300 pages, but the same constituent elements occur on every page: "J.'s" friendliness, waywardness, temper, as well as his interest in society, travel, theatres, museums, buildings, architecture, books and libraries; and the serious part of the book, which deals with the development of the study of the natural sciences at Cambridge, finds accommodation in two appendices. But, by the same token, those who read the book with some knowledge of local colour will find it an epitome of Cambridge in the nineteenth century, opportunist, casual of purpose, wayward, but effective and progressive.

Look at the beginnings. "J.'s" father, William Clark, the second son of a Newcastle doctor, was sent to Trinity in 1804, became a scholar in 1807, seventh wrangler in 1808, fellow of Trinity in 1809, "having especially impressed the examiners by a brilliant rendering of a passage of Pindar into English verse." He "walked the hospitals" in London, was admitted to holy orders, and at the age of twenty-six became a candidate for the "professorship of anatomy." The election was *more burgensium*. Lord Byron was a distinguished supporter. Clark failed on the first occasion, but succeeded later, and became professor of anatomy in the University at the age of twenty-nine—a fine instance of casualness of purpose, waywardness, and effectiveness on the part of the University.

At that time the domination of the colleges over the University was complete. The heads of the seventeen colleges were the governing body; pairs of colleges took it in turn to "police" the undergraduates, and to examine them all for their degrees. The head was "the only permanent officer of the college"; indeed, the other offices were mostly held at his pleasure. It is a common misunderstanding to suppose that the matrimonial restriction operated to prevent fellows marrying; its real effect was to restrict the college appointments to what would now strike us as extreme youth. A few confirmed bachelors who had taken holy orders lingered on in residence, and sometimes even attained old age, but they soon became superannuated for college work and fossilised. Lecturers were often Bachelors of Arts, and an appointed tutor has had to wait for the completion of his M.A. degree before he could fufil all his functions. Veritable history speaks of a college don who, having passed through all the range of college offices, was regarded as quite past work, and only waiting until it should please Providence to call him to his rest, and who, on inquiry, proved to have attained the ripe age of thirty-five years. He is, however, still in this world of care, again enjoying a well-earned rest, though he has some thirty years of service in a country living to add to the record which forty years ago was regarded as complete.

Thus when "J.'s" father took up the duties of professor of anatomy, the permanent staff of the University and colleges made up a small and select society of seventeen heads and twenty-five professors, with a registrary and librarian, three bedells, and eleven "cormorants," members of the senate *commorantes in villa*. The selectness and closeness of that society are still the subject of many Cambridge anecdotes, some of which are included in "J.'s" charming reminiscences, reprinted from the *Cambridge Review*, in the volume before us; but what is forgotten is that there must have been a yawning gulf of age between the average college don and the permanent society which, as years went by, had necessarily to rely more and more upon its dignity rather than its activity for the respect of the rising generation. The social amenities of college life naturally remained mediæval, and to a certain extent they are so yet. It is still an accepted principle that the simple labour of the bedmaker is to be preferred to the devious machinations of the plumber for carrying bath-water to and fro.

Into this close society "J." was born in 1833, with one of the twenty-five professors as father, and another, Robert Willis, as uncle; the biography does not say what he thought of professorships, but he never developed that respect

for headships of colleges which continues to be the keystone of the structure of Cambridge society.

He was sent to Eton, where he was not very happy, and then passed on to Trinity. As an undergraduate he wrote with characteristic exaggeration: "Really, I cannot but think it quite monstrous that everyone is to waste four-and-twenty years of their life in learning two dead languages which can never be of the slightest use to them"; but he obtained a place in the first class of the Classical Tripos in 1856, and his exertions were rewarded by a fellowship in 1858. Vacancies were not so scarce then as they are now; the average tenure was, no doubt, much shorter. "I never ought to have got a fellowship, but there happened to be eight vacant that year, and they gave me one."

It was the same all through his life—things happened. After obtaining his fellowship, he proceeded to amuse himself with foreign travel and otherwise. "He took an active part . . . especially in the A.D.C.," and so he became for many years stage-manager of the University for dons and men, and the drama was his hobby. When his fellowship lapsed, in 1866, he retained his rooms in Trinity because he was supposed to be engaged upon the college records, and he was deputy junior bursar in charge of the buildings, and deputy librarian in charge of the books. He only returned the muniments which gave him a title to rooms, duly "calendared," forty-four years later, but he soon became the leading authority on college buildings and the care of books. His father included comparative anatomy in the subject which he professed, and collected specimens in illustration. When he grew old, his classical son helped with the "museum," and so, when his father resigned, became superintendent of the Museum of Comparative Anatomy, while human anatomy went to G. M. Humphry, and a new professorship of zoology was created. The attitude of the new professor to the Museum of Zoology and Comparative Anatomy is characteristic of himself and of one side of Cambridge.

"The prevalent belief, I take it to be, is that the professor of zoology ought to look after the museum. I need not say how absurd this is. . . . One notion that underlies it all is that your salary (!) may be saved to the University, which, of course, is false, because I should never, under any circumstances, take on me such additional duties without an equivalent."

The appointment as superintendent and the lapse of his fellowship, since "J." was not in "orders," occurred in the same year; and, at the same time, he became a member of the newly formed Museums and Lecture Rooms Syndicate, and later he became secretary. The history of this syndicate, now at an end, is neither more nor less than the history of the development of the study of the natural sciences in Cambridge, and it nearly all "happened" while "J." was secretary. How it all happened, perhaps no one can say; new statutes and a Royal Commission, a few far-sighted dons, and private benefactors had something to with it, but "J.," without professing anything, or being what one could call a don, was there all the time, a sort of nucleus for growth. That "J." was a Trinity man goes without saying, but, perhaps more than anyone else, he stood for the University as distinguished from the colleges. Of his college he became auditor, a sort of external guardian, but of the University he was so much a part that the statutory offices of librarian and registrary, for which the colleges had never claimed a right in rotation, seemed his own. Popular election gave him the latter in 1891, and in that he served the University until close upon his death in 1910.

In 1873, when his position in Cambridge was established, "J." happened to propose to, and marry, Miss Frances Matilda Buchanan, whose father was at the time British Ambassador at Vienna. According to his biographer, this was the best thing he ever did, and certainly he owed to it no small part of his success as a man of the world. The book abounds with stories and letters of affectionate family life, of deep and lasting friendships, and of unconstrained sociability with all men of proper tone, quite irrespective of age or academic standing. "J." was a very helpful friend, but he never patronised.

Thus "J." made the most of a very fortunate opportunism; he never set out deliberately to be a zoologist, or a man of books, or an archæologist, and he certainly did not try to be a social success; yet he was all these things because they came in his way.

How like to his University! While "J." lived his life, Cambridge, out of the rivalry of her colleges, developed from her "tripos" a scheme of examination which has overspread the Civil Service and the whole educational system of the country, without any more motive than to "doe the nexte thyng." It has somehow added study to study, laboratory to laboratory, museum to museum until it has obtained a magnificent establishment for the University, as distinct from the colleges, and the old close society has become absorbed in a larger life. Those who remember the material provision which the University had in the early 'seventies for Maxwell, Stokes, Foster, Liveing, Dewar, and compare it with the scientific palaces that are now to be found there

about, will naturally look for some well-laid scheme for fostering all the subjects that are called scientific. They will find something *à propos* in the action of the Commissioners of 1877; but, so far as the spontaneous action of the University is concerned, it is all very much "as it happened." Other universities may set out to rear proconsuls, and succeed therein, but Cambridge leaves her actions to define her ambitions. If she prepares for nothing, there is nothing which she is not prepared for, if only opportunity offers.

Like "J.," if there are museums to be tended, she is a zoologist; if there are books to be cared for, she learns about libraries; if there are buildings to think about, she is an archæologist, or at least an architect. One is reminded of the person whom Mark Twain once set to music in words like these:—

> Whate'er this man is sot to do
> He'll do it with a zest;
> No matter what his training is,
> He'll do his level best.

There are, indeed, few things in this world that the well-trained Cambridge man has no opinion about; he generally knows at least how they ought to be done. A few weeks ago a typical Cambridge man, confronted for the first time with an elaborate contrivance, the result of years of effort, for eliciting some of the secrets of nature, gave expression to his admiration by suggesting that it was probably based upon an erroneous principle. The danger of the Cambridge opportunism is that the opportunity of doing the same things over again, but, of course, better, is such a tempting by-path leading away from the object for which the things are done at all.

The Cambridge man has the examiner's instinct in his bones; he is so accustomed to examining everything that his first impulse is to assign marks—but not too many. "I should give 75 per cent. for the sort of answer I would have written myself," as a colleague examiner once said. It may be that, in the same way, the instinct of the sister university, on being confronted with a new fact, would be to write an essay about it (which might come in useful sometimes), but Cambridge still holds by "Mr. Tripos," and cannot help beginning the consideration of any subject by a "nego majorem," if possible.

One ought not to omit the biography of Sedgwick, written in conjunction with Prof. McKenny Hughes, but "J.'s" chief contributions to our knowledge were his four monumental volumes of the architectural history of the University and colleges of Cambridge, begun by his uncle, Robert Willis, his dramatic work, and his numerous books and pamphlets on libraries and the care of books, while his ostensible business in life was the Museum of Zoology and Comparative Anatomy. According to his own account, had Frank Balfour lived, he would have devoted himself to science, but, unfortunately, Balfour perished. Here, again, through him we see his University. With its seventeen colleges it now includes a vast staff of persons of the highest competence, whose ostensible duties are to teach, but how many of them become known to fame for their teaching? One hears more often of their attaining eminence as "good business men," and, indeed, the curious art of expert management of affairs by unpaid syndics seems likely to overspread the land like the examination idea. Perhaps Rhodes might have had some opinion on the subject; he might have thought, with some justice, that the syndic was apt to take out his value in time, as there was no question of money. It may be either pious or profane to say it, but in its indirectness of purpose Cambridge is distinguished from the great world outside, and the Cambridge man is apt to carry with him the opportunist idea which abounds on the Cam, that his chance of distinction lies in making and using opportunities to do something else.

Dear "J."; one wonders what he would have said at his biography being made a spyglass to look at his University with; something forcible, no doubt, if not polite. It was not any sublime absence of human failings that endeared "J." to successive generations of Cambridge men. His jaunty walk, the suggestion of being on good terms with himself and all the world, the air of possession when some purpose happened to have become his own, and the natural conclusions to be drawn from the fact that, whatever happens, one has to dine somewhere, made his society a real addition to the joy of life.

And, after all, if one takes out "J.," and writes Cambridge instead, there would be nothing much to alter. Alma Mater—Carissima! you are provokingly irresistible. How can we but adore you when, in reply to the suggestion that with a scheduled income of some 300,000*l.* a year you might easily present the magnificent spectacle of a self-governed world speeding onward towards the light, you say (and really think), "Tut-tut—it's all a misunderstanding; we are really seventeen sisters and a mother, old and very poor, as poor as can be, especially the mother." *Hinc lucem et pocula sacra!* yet you are very human, and by taking advantage of this opportunity and that, you have surely moved onward in the last century

more than any of your sons would have thought possible.

To the presbyopic eye, looking backward over the dim years, it seems that it must have been the people of "J.'s" type in Cambridge who have really counted in the revolution of the nineteenth century. "All the world's a stage," and a born stage-manager has, perhaps, as much to do with the success of a play as the "stars" themselves.

THE FLEUR-DE-LYS.

The Genus Iris. By W. R. Dykes. With Forty-seven Coloured Drawings by F. H. Round, One Coloured Plate of Seeds by Miss R. M. Cardew, and Thirty Line Drawings by C. W. Johnson. Pp. 245. (Cambridge University Press, 1913.) Price 6*l.* 6*s.* net.

NO more fitting tribute could have been prepared to the memory of Sir Michael Foster than a monograph of the group of plants he loved so well and studied with so deep an interest, and the volume produced by Mr. Dykes would without doubt have evoked Sir Michael's warmest approbation.

The genus Iris, like Crocus and so many other monocotyledonous genera, offers a particularly fascinating field of study from the beauty of form and colour displayed and the remarkable diversity of the species. Mr. Dykes is to be congratulated in having cultivated the majority of the species in his own garden, and with such success that the illustrations, with but one exception, have been prepared from the plants grown by him at Godalming. These illustrations, by Mr. F. H. Round, are elegant works of art which have been very faithfully reproduced in colour, and form a valuable addition to the volume. The Cambridge Press deserves a special mention in this connection, both for the beauty of the plates and for the style in which the monograph has been published.

Mr. Dykes has spared himself no pains in searching English, Continental, and American herbaria for his material, and, in particular, Kew, with its herbarium and library, proved to be a mine of wealth. He has wisely studied the type specimens with the original descriptions of all the "species" of Iris, and has thereby been able to arrive at a definite idea as to the actual number of such "species" as are really worthy of specific rank. By ignoring the records of species in local floras, unless they could be verified by actual specimens, Mr. Dykes may have left some gaps in the distribution tables of some of the species, but he has certainly avoided many possible sources of error.

Irises are not only plants of interest to the gardener, but they are also of interest to the plant-breeder for the facility with which they may be hybridised. In this direction the late Sir Michael Foster was, of course, an expert, and the hybrids he produced were always a source of the keenest pleasure to him.

In addition to the ease with which hybridisation may be effected, variation is also characteristic of many species, and it is owing to this tendency that so much confusion as to the limits of species has arisen. Mr. Dykes has constant occasion to allude to this fact, for not only do the plants vary in their wild state, but they show themselves particularly prone to manifest variations under cultivation. Mr. Dykes, however, has been in no hurry to rush to conclusions, but has taken time thoroughly to digest the mass of material which he has studied, and botanists, we feel sure, will agree that they owe him a deep debt of gratitude for the sound and careful work he has done.

The early pages of the monograph are occupied by general matter dealing with the literature of the iris, structure, distribution, and cultivation, followed by outlines of the different sections of the genus. The species are then described very fully under their respective sections, with full citations of specimens and detailed setting-out of their geographical distribution, followed by useful notes on the affinities of each species.

It is not possible to attempt any criticism of this the essential part of the book, and its merits can only be adequately realised by one working over the material. It may, however, safely be said that Mr. Dykes has produced a work with much care and sound judgment, the value of which will increase as years pass by.

THE CHEMISTRY OF FATS AND ALLIED SUBSTANCES.

Chemie der Fette, Lipoide und Wachsarten. By Dr. W. Glikin. Erster Band: pp. xvi+789; Zweiter Band: pp. xi+788. (Leipzig: Gebrüder Borntraeger, 1913.) Price, 2 vols., 72 marks.

A NOTABLE feature of this work is the amount of consideration given to the physiological chemistry of the fats, and to the general chemistry of the lipoids. The question of the origin of fat in the animal body is of much interest and importance; and in the earlier chapters of the first volume Dr. Glikin gives an account of the experimental evidence on which arguments have been based to show that the fat of the animal body may be produced from fat

ingested as food, or elaborated from proteid substances, or from carbohydrates. Doubtless the accounts of the experiments are often ancient history, going back, as they do, to researches of Hoppe-Seyler in 1859, of Pettenkofer and Voigt in 1869, and to various controversies in subsequent years. They serve, however, to give a connected survey of the whole matter.

The lipoids, it should perhaps be mentioned, are substances more or less closely associated with the fats, and extractible by organic solvents from various parts of animals and plants. Some—the phosphatides—contain both phosphorus and nitrogen; others contain nitrogen, but not phosphorus; others, again, contain neither of these elements. They are of much physiological importance, and during recent years have been much studied by Windaus, Diels and Abderhalden, Cousin, Rosenheim, and other workers. Cholesterol, phytosterol, lecithin, and cerebrin may be mentioned as some of the best-known representatives of the group. The author gives a full description of this class of substances and their compounds, though he regrets that lack of space prevents his discussing the behaviour of lecithin under hæmolysis.

The general chemistry of the fats and waxes is treated at considerable length. Besides the usual descriptions of the acids, alcohols, and glycerides which compose the oils, fats, and waxes, the text includes discussions of the constitution of some of the principal fatty acids, and of the properties of their salts and other compounds.

The remainder of the first volume is devoted to a description of the methods in vogue for the analysis of oils, fats, and waxes. An alphabetical order is adopted in tabulating the various physical and chemical data; this plan is convenient for ascertaining the characteristics of a known oil or fat, but for help in classifying an unknown article it might well be supplemented by a table arranged according to the values of the iodine number.

In the second volume the preparation and examination of the individual oils, fats, and waxes are dealt with. For each article an outline of its origin, method of preparation, and properties is given, followed by tables of the physical and chemical constants appertaining to the substance and to the fatty acids separable from it. The closing chapters are concerned with various manufactures allied to the fat industry, such as the making of soap, varnish, glycerin, and stearin.

The author's aim has been to produce a connected treatment of the whole subject, and his book is probably the most complete work of the kind yet published. C. S.

OUR BOOKSHELF.

Weights and Measures Act, 1904. Board of Trade Notices Annotated. By H. Cunliffe and G. A. Owen. Vol. i. Pp. viii+199. (Smethwick: H. Cunliffe, 1913.) Price 5*s*. net.

THIS work is intended for inspectors and others interested in the administration of the Weights and Measures Acts. Under the Act of 1904 the Board of Trade was empowered to examine as regards material and principle of construction such patterns of weights, measures, weighing or measuring instruments as might be submitted to it, and to issue certificates in cases where the patterns were found not to facilitate fraud. From time to time the Board issues notices setting forth its decisions with respect to such submissions, and the writers of the present volume have collected together the first fifty of these notices and publish them with criticisms and explanatory notes.

The authors are inspectors of weights and measures of considerable experience, and their book appears likely to be useful to persons preparing for the Board of Trade examination for certificates of qualification as inspectors, as well as to such acting inspectors as may find difficulty in identifying patterns from the information given in the Board of Trade notices. It is usual for the inspectors' examination to include a question requiring a description of the functions of the various parts of a pattern illustrated in one of the notices, but owing to the fact that some of the patterns represent instruments which have never been put on the market, or are in very restricted use, such information is rather difficult for a candidate to obtain.

The descriptive letterpress which accompanies the notices in this work is very complete, the annotations and detailed explanations as regards the various weighing instruments considered being particularly good. A few blemishes are noticeable here and there: for example, there is an omission on p. 6 in the citation of section 5 (*a*) of the Act, which renders some of the remarks on p. 8 not readily intelligible. The interpretation of instruction 35 given on p. 12 is forced and misleading. On the whole, however, the work appears to have been prepared with great care. The authors propose to deal with later issues of the notices in a subsequent volume.

Text-book of Zoology. By H. G. Wells and A. M. Davies. Sixth edition. Revised by J. T. Cunningham. Pp. viii+487. (London: W. B. Clive, University Tutorial Press, Ltd., 1913.) Price 6*s*. 6*d*.

THE supplement which Mr. Cunningham added to the fifth edition of this popular text-book has now been incorporated in the body of the work, and the section dealing with the Invertebrata has been rearranged so that the types follow in general the descending order in classification. Important additions have been made explaining the facts and theories of most importance to modern biologists in relation to the problems of evolution.

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.*]

"Cheiropleuria bicuspis" (Bl.) Pr.

THROUGH the influence of the Rajah of Sarawak and the activity of the director of the museum there, to both of whom my grateful thanks are due, I have recently received an ample supply of specimens, dried and preserved in alcohol, of the uncommon Malayan fern, *Cheiropleuria bicuspis* (Bl.) Pr. As some considerable time must elapse before its details can be worked out, I think it will be well to state briefly certain points of interest in relation to it.

The creeping rhizome, which is covered with hairs, not scales, bears long petiolate leaves at intervals, which are variable in the form of the lamina. Some, especially those of the smaller plants, have an ovate acuminate outline, others may be two- or three-cusped, or in large plants the number of lobes may be four or five. In these cases there is an obvious bifurcation of the lamina, a point well shown in Sir W. Hooker's illustration of the species, quoted as Fig. 175 in Engler, u. Prantl., i., 4, p. 337. The relation of the leaf and its venation to that of Dipteris is very marked in the larger examples. There can be no doubt that the nearest affinity of Cheiropleuria is with the Matonineæ.

The fertile leaves appear to be always simple, and of narrow form. Their lower surface is covered by a dense mass of sporangia and hairs, in an Acrostichoid manner. The sporangia themselves have an oblique annulus, and the various ages of them are intermixed.

As against these rather advanced characters, the anatomy presents surprising features of simplicity. The rhizome appears in the Bornean specimens to be constantly protostelic, with much parenchyma, not solenostelic, as stated by Christ ("Farnkraüter," p. 128). The leaf-trace comes off as a single mesoxylic strand, which soon opens out and becomes semilunar, and then divides into two equal strands. These characters indicate, on one hand, a greater similarity to Mertensia in the mature stock than is shown by any Matonioid fern; on the other an advance on Matonia and Dipteris, both in the anatomical and the soral condition of the leaf. The effect of these facts upon the comparative position will be, on one hand, to strengthen the relation of the Matonioid series to the Gleicheniaceæ; on the other, to illustrate a further step in advance in foliar character than any of them show. The relation to Platycerium has been definitely indicated by Diels ("Naturl. Pflanzenfam.," i., 4, p. 336). It will remain for more detailed inquiry into the structure and development of both of these genera to show how far Cheiropleuria approaches Platycerium. Conclusions on this point must be deferred for the present, though certain facts appear provisionally to support such an alliance.

F. O. BOWER.

Botanical Department, University of Glasgow, July 18.

Cupriferous Sandstones at Exmouth.

OBSERVATIONS made last winter upon the lithological characters of the Red Marls, with intercalated sandstones, exposed in the cliff-section running eastwards from Exmouth towards Straight Point, disclosed some interesting facts which may serve to remove doubts as to these rocks having been formed under conditions contemporaneous with, and similar to, those prevailing during the deposition of the German Rothliegendes in Permian times.

The sandstones consist of very smooth and rounded grains of quartz, and what appears to be cornelian, together with copper and manganese, consolidated by a calcareous and dolomitic cement. The copper occurs as a green carbonate derived from the decomposition of minute particles of copper pyrites present in the rock. Vivid green patches and specks of this copper carbonate are very conspicuous on the surfaces of bedding-planes and other places where water has percolated freely. Mr. F. Southerden, of the University College, Exeter, kindly analysed some of the specimens, and an average sample yielded about 1 per cent., and a richer specimen more than 3 per cent., of the carbonate. None was found in any of the marl, nor in the *red* sandstones of Rodney and Orcombe Points.

The manganese is very widely distributed, both in the red and the buff sandstones, as minute black specks, frequently rudely dendritic in arrangement, and as films coating the grains of quartz. Occasionally large areas become quite black with it. Where copper is present manganese is always present also, but manganese is frequently present without the association of copper.

The grains of quartz composing the bulk of the sandstone are remarkable for their roundness and smooth surfaces. Much research in reference to sands leads me to believe that they were originally rounded by wind action, and subsequently polished by water holding finer matter in suspension. The natural disintegration of this type of sandstone produces a sand which, when sifted by wind and wave on the sea-beach, should be musical, but it was not until May last, after many visits, that I found several very musical patches on the beach between Rodney and Orcombe Points, and also under the "High Lands of Orcombe."

In places along the foot of the cliffs the lime in the cliff-springs cements the beach material into solid masses of sandstone and conglomerate, and dry sand, blown from the beach against wet places on the cliff-surfaces, eventually becomes consolidated into great cakes of sandstone for the same reason.

CECIL CARUS-WILSON.

A Fresh Feature of the Large Larch Saw-fly Outbreak in the Lake District.

IN the Lake District plantations, and elsewhere throughout the country, those interested in the welfare of the larch have viewed with no little apprehension, for some time past, the yearly ravages of the large larch saw-fly (*Nematus erichsonii*). As direct methods of control are out of the question over most of the affected areas, interest has been centred upon those natural agencies which in any way tend to limit the indefinite multiplication of this saw-fly, and it has been recognised that the atmospheric conditions, several of the common insectivorous birds, voles, certain insects, and parasitic fungus, are all capable of exercising a considerable if variable influence upon the numbers of the pest. To a combination of forces such as these must be attributed such respite as the trees have gained in certain of the infested areas, and in those cases where accurate observation of the facts was possible it was found that cessation of the saw-fly attack coincided with an overwhelming increase in the numbers of one of its insect enemies, an ichneumon, hitherto unknown to science, *Mesoleius tenthredinis*, Mor. This parasite, by eventually accounting for more than 70 per cent. of the larvæ within the cocoons, undoubtedly in these instances played a very large part in the reduction of the pest.

As *M. tenthredinis* was known to be present in

most of the districts where the larch saw-fly was making itself felt, and as none of the other parasitic hymenoptera or diptera recovered from the cocoons from year to year showed signs of attaining to anything like its efficiency as a parasite, it was felt that the eventual control of the pest possibly depended largely upon the future activities of this one species. Hence the following observations made during the present season may be of interest in so far as they indicate the probability of other of the parasites attaining to a like importance.

Shoulthwaite plantation at Thirlmere, the first in that area to suffer from attack, endured during several summers the severest defoliation, until in 1910, owing to the good offices of *M. tenthredinis*, the ravages of the pest abruptly and almost entirely ceased. In 1911 it was impossible to obtain from there any further cocoons for the purposes of the investigation owing to the scarcity of the saw-fly. In 1912, however, this plantation was invaded by a vast swarm of adult saw-flies, which there was reason to believe came from a badly infested plantation some three miles away. Owing to a period of very unfavourable weather, and perhaps to other causes, the defoliation that ensued was not at all so extensive as it was feared it would be; however it was distinctly noticeable, and the consequences of this re-infection of the area were looked forward to with some anxiety. Would the trees, weakened by the old outbreak, have to submit to renewed defoliations, until such time as *M. tenthredinis*, re-emerged Cincinnatus-like from its obscurity, regained sufficient strength to overcome the progeny of the invaders? An examination of the parasites that have emerged this year from cocoons collected in this area revealed a quite unexpected state of affairs. Scarcely 2 per cent. of the cocoons proved to be parasitised by *M. tenthredinis*, but some 25 per cent. yielded specimens of an ichneumon which had hitherto played quite an insignificant part as a parasite of the large larch saw-fly (a species of Mesoleius, as yet undetermined). From approximately 24 per cent. emerged tachinids belonging to the species *Zenillia pexops*, B. and B. (Mr. C. J. Wainwright, who kindly identified it for me, informs me that he knows of but one other record of its having been taken in Britain.) It seems highly probable that both these parasites have followed in the wake of the invading saw-fly, particularly as observation of material from the locality from which it was suspected that the latter had flown has shown that the tachinid at all events is exceedingly abundant there.

It is impossible as yet to have direct proof of the efficacy of these two parasites in warding off defoliation in the areas in which they have so opportunely appeared, but it is very reasonable to suppose that, here and elsewhere, they will prove to be important enemies of the large larch saw-fly.

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the University of Manchester.

Mackerel and Calanus.

REFERRING to Prof. Herdman's interesting observations upon the above (NATURE, July 17), I may perhaps mention that the mackerel-drifters, when fishing upon the usual grounds around Scilly and in the Bristol Channel, are largely influenced in their selection of a suitable position by the finding of so-called "yellow water." This condition of the sea in the area under consideration arises from the presence of vast shoals of Calanoids—*e.g. Calanus finmarchicus, Pseudocalanus elongatus*, &c.—which impart a yellowish tint to the surface of the water. The sporadic distribution of such copepods, moreover, is often somewhat remarkable; the fishermen state that it is possible at times to observe the entire extent of a "splat" of "yellow water."

The presence of mackerel is generally to be expected in water of this character, but heavy catches are not invariably made in it.

G. E. BULLEN.

The Hertfordshire Museum, St. Albans.

THE FUTURE OF OIL FUEL.

THE position of liquid fuel has increased in importance far beyond any expectations its most enthusiastic advocates of but little more than a decade ago ever dreamed, due to the rapid advances made in its use in internal combustion engines. The success of engines of the Diesel type, which can employ crude oil or heavier residues after the lighter fractions of the crude oil have been removed for other applications, has furnished the completing link in the use of oil in such engines. With the petrol engine, slow-speed oil engines working on ordinary burning oil (kerosene), and the Diesel and semi-Diesel engines, high efficiency is now assured with any fraction of the natural oil.

The importance of liquid fuel and the certainty of its more extensive use in the Navy rendered it imperative that the whole question, especially that of supply, should receive consideration, and led to the appointment of the Committee now sitting. The advantages of oil fuel for steam raising were dealt with fully in these columns so far back as 1902 (vol. lxvi., p. 186), when oil fuel was in its early trial in the Navy.

The present general position and future policy of the Admiralty were outlined by Mr. Churchill in a reassuring speech before the House of Commons on Thursday last. Whilst the crude oil output for last year was nearly 50,000,000 tons, Naval requirements were met by fewer than 200,000 tons, and the Admiralty have assured themselves of obtaining all requirements in time of war, so long as British command of the sea is maintained.

This necessarily involves obtaining supplies by suitable contracts, and drawing specially upon supplies under British control, which is now possible from the Mexican fields. A far-reaching step in national policy is the further proposal to establish an oil refinery, so that crude oils may be dealt with as they come cheaply into the market. It is not only essential to have some measure of control of the supply at its source; it is equally essential to provide ample storage and transport facilities. The former has been arranged for on a large scale in this country and throughout the Empire, and by the end of 1914 the Admiralty will possess thirteen transport steamers, the five largest of which have a carrying capacity considerably greater than the quantity of oil fuel consumed throughout the fleet last year.

In connection with the subject of oil fuel, three Cantor lectures recently delivered by Prof. Vivian B. Lewes before the Royal Society of Arts[1] are of especial interest. The first lecture was

[1] Journal of the Royal Society of Arts, May 23, 30, and June 6, 1913.

devoted principally to theories on the formation of petroleum, and to the composition of natural crude oils. In the second lecture methods of combustion for steam raising, and, briefly, its use in internal combustion engines, were considered. Particular interest attaches to the possible high efficiency attainable when utilised for steam raising by Prof. Bone's surface combustion system. It is, however, in the third lecture that we find the all-important questions of supply discussed. Euthusiastic advocates of the advantages of oil fuel—advantages which are admitted—often forget that, with small exception, liquid fuel must always be an imported fuel in this country, and that the questions of supply and price must depend on a variety of factors, not the least important being that of transport. Prof. Lewes rightly emphasises the fact that trusts and rings are by no means wholly responsible for the recent high price of petrol; there is the big question of enormous increase in consumption with nothing like a corresponding increase in production Referring to this high price, Prof. Lewes says:—

> The way to keep the price of petrol within reasonable bounds is not by letting the imagination run riot on the subject of trusts and rings, but to develop steadily all processes that will increase the supply, not only of petrol, but petrol substitutes, always bearing in mind that with the present consumption ever increasing, petrol itself cannot supply the market for even another ten years, and will probably be a rarity as a motor fuel before the end of the century.

This naturally leads to a reference to processes for "cracking" heavier oils to produce lighter fractions by the breaking down of the heavier hydrocarbons, and a description is given of one of these processes in which oil mixed with water is sprayed through heated iron retorts filled with iron turnings.

Referring to sources of supply other than petroleum oils, it is shown that shale distillation in this country can yield only an infinitesimal fraction of the petrol consumed. Benzene (benzol), obtained from coal-gas and coke-oven tars, being a native product of proved value as a motor fuel, is discussed. Prof. Lewes says that if the whole of the benzol from the 32 million tons of coal annually coked in coal-gas and coke-oven practice were recovered, a very considerable supply would be assured, but under existing conditions less than half the coke is obtained in recovery plant (it may be noted that the use of recovery ovens is extending rapidly), and most of the benzol goes abroad. Prof. Lewes appears to advocate removing the tax on petrol and the imposition of a tax on export benzol as a means of obtaining an important addition to our supplies of motor fuel.

Heavy fuel oils, suitable for steam raising and for internal combustion engines, constitute 50 per cent., or even more, of the crude oil. Prof. Lewes anticipates no such shortage in supplies of these oils in the future as has existed for some time past, for "the distillation of every available supply to yield petrol must result in enormous volumes being thrown on the market." The present shortage is ascribed to the better price of petrol giving it preference for shipment during a period when there is great lack of transport facilities. With the increase in the number of tank steamers (many yards are busy with such vessels) he anticipates that the enormous stocks held in many fields will become available.

IS CANCER INFECTIVE?

NOTWITHSTANDING that no analogy has been shown to exist between cancer and any known form of infective disease, the contrary is often asserted without proof, as a kind of creed, by well-meaning and enthusiastic students of the disease. A recent lecture illustrates the importance of the influence the latter view may come to have upon the public in general. Whether it is wise to put forward such views before a non-critical lay audience is open to doubt, even if they are told "there is no risk of direct infection, although it is better to avoid direct contact by kissing, by using in common table porcelain, clothing, or beds."

In a popular lecture[1] delivered at the Urania, in Berlin, Dr. V. Czerny, the famous surgeon, gives a clear account of the reasons why, after forty years' experience in surgical practice, he still holds that cancer is an infective disease. According to him it is communicable, not directly, but through an intermediate host. Once the infection is conveyed, the normal cells become changed, they destroy the organism not only by disturbing functions vital to life, but also because, like real parasites, the cancer-cells withdraw necessary foodstuffs, as well as secrete abnormal products of metabolism, viz. toxins which poison the organism. Czerny supports his view by arguments as to the varying frequency of the disease in different countries and in different districts of the same country, the alleged occurrence of epidemics of cancer, of the eyelid in cattle, of the thyroid in trout, and of cage epidemics in mice; but he neither points out the statistical and pathological fallacies that underlie the assertions of the authors whom he quotes, nor takes cognisance of the explanations more cautious authors have given of the apparent differences and "epidemics" upon which he depends. Every precaution necessary for the statistical study of cancer in man applies with even greater necessity to animals, since the data obtainable from an animal population can be controlled at will by the investigator. Unless these precautions are taken, weight may not be attached to reasoning from such imperfect data without important reservations.

Bugs, mucors, mites, worms, cockroaches, bilharzia, filaria, acid-fast bacilli, &c., are alleged as possible intermediate hosts of "the ubiquitous cancer parasite," which may be a protist, but more likely is an ultramicroscopic organism "which constantly secretes a chemical irritant. If one

[1] "Ueber die neuen Bestrebungen, das Los der Krebskranken zu verbessern." By Dr. Czerny. *Himmel und Erde*, Heft 7, April, 1913. Also published separately by B. G. Teubner, Leipzig and Berlin.

conceives of these micro-organisms being adapted to the diseased cells and disseminated along with them by the lymph and blood-streams, a satisfactory explanation of the features of cancer in man is obtained. It is conceivable that there are a number of different micro-organisms which produce these irritating substances, and that there is not a single cause of cancer." The "ubiquitous parasite" finds entrance into the body by the openings made in the case of X-ray ulceration, chronic inflammation of all kinds, *e.g.* of the breast, the ulceration of the tongue following on the irritation of a jagged tooth, catarrh of the stomach due to alcohol or tobacco, ulcer of the stomach, ulcer or catarrh of the large intestine due to constipation; entrance for the parasite may even be made possible by congenital anomalies, &c., &c.

Although no evidence is adduced in support of these conceptions, any alternative to such an infective causation, involving as it does the further hypothesis of symbiosis of the parasite and the cancer-cell, is ruled out of court by Czerny. He says: "On account of the numerous errors made in the past, many pathologists have given up the search for a cancer parasite, and content themselves with some ingenious cellular theory, which suffices for instruction, but does not yield actual practical applications." Surely no practical application can yet be made of the infective hypothesis of the cause of cancer, although the taking of quite fallacious cancer censuses has been based upon it. The importance actual observation has given to chronic irritation has long since justified legislative measures for the protection of workers engaged in various occupations from enhanced liability to the disease.

Czerny reviews optimistically recent attempts to influence the growth of tumours by radium, X-rays, fulguration and chemical means, sera, &c., but his forty years' personal experience as a distinguished surgeon of international fame adds greater weight to his important announcement: "Unfortunately, the first beginnings of cancer are often so insidious that they do not attract the attention even of the patient himself, who first seeks medical advice when ulceration, a palpable tumour, pain—that faithful guardian of health—long-lasting digestive troubles, wasting, and bad looks warn him. Nevertheless, early diagnosis and removal of a condition *long remaining localised,* is the best means of restoring to complete health and avoiding the sad chain of consequences of the advancing disease. Therefore, with the assistance of anæsthesia and asepsis the surgeon has gradually sought out tumours in all organs of the body, even in the brain and spinal cord, and removed them. Naturally cancer comes under operation later, and therefore in less favourable circumstances the more inaccessible its situation. If success for tumours of the brain and spinal cord is rarer, still in the case of the skin 80–90 per cent. of cures can be depended upon. Complete cure in the case of the breast is obtained in 40 per cent., *i.e.* living and controlled five years after operation. For the stomach and intestine, 20–30 per cent. of success can be calculated on."

Since the first vague statements of the cure of transplanted cancer in mice by chemical means were made there has been a rising flood of similar announcements in scientific journals. According to the experience of the writer the greater number of these communications had better never have been published. The results claimed as cures have been for the most part nothing of the kind, but due to errors, sometimes arising in the properties of the tumour unknown to the "curer," at other times due to the observer being unaware of the behaviour of transplanted tumours in general and of the behaviour of a particular tumour obtained from some other laboratory, the observer being inexperienced both of how to obtain uniform growth and of the numerous fallacies he has failed to avoid. Shots in the dark, by those inexperienced in the growth both of experimental and natural tumours in animals, are, however, to be expected until more is known of the nature, chemistry, and metabolism of cancer, and certainty is attained as to whether or not it is an infective disease. But it would be a grave misfortune if the increasing flood of alleged cures of transplanted cancer in animals led to an augmentation of the number of persons who, disdaining or fearing surgical advice and treatment, prefer "treatment" by some other less efficacious or even useless method, or by some of the new chemical preparations already prematurely placed upon the market.

E. F. BASHFORD.

PLANKTOLOGY ON THE PACIFIC COAST.

THE school of marine planktologists at the University of California and the biological station of La Jolla (San Diego) is doing notable work on the Pacific under the expert guidance of Profs. Ritter and Kofoid. We now welcome a recent contribution on the classification and vertical distribution of the Chætognatha of the San Diego region, by Ellis L. Michael (University of California Publications in Zoology, vol. viii., no. 3). To begin with, the material is evidently very abundant. The locality in question shows seven out of the eighteen valid species of Sagitta, two of the three species of Eukrohnia, and one of the two species of Spadella. The author has done good work in redescribing and elucidating those species, and is to be congratulated on having failed to discover any new ones. The work has been confined to a comparatively small area, but it is evident that no pains have been spared to make it complete.

The author states: "We are convinced that direction and velocity of currents, temperature and salinity of water, wind, clouds, fog, rain, light and darkness all affect the distribution of plankton *even within a very small area.* The influence of all these conditions must be known to solve any problem concerning the quantitative distribution of plankton." All these influences have been very fully investigated.

The systematic part of the work contains a most useful revision of the known species of Chætognatha with a detailed key giving brief diagnoses of the genera and species, as well as a fuller statement of characters, with measurements of many specimens in the case of most species.

In the very full discussion of the problems of distribution, illustrated by many tables, we find that our author considers that his data contain numerous examples illustrating lack of uniformity in distribution. Some of these examples are as follows: In two hauls of the same net in the same region on the same day the number of *Sagitta bipunctata* varied from fifteen at 6.20 a.m. to one at 7.20 a.m. per unit volume of water. On another day, under similar conditions, the number varied from twenty-five to one, and on another day similarly from one to fifty-six, and on still another occasion from 135 to one. "Other instances might be cited, but enough have been given to show that the surface-distribution of *S. bipunctata* is not constant for any length of time, even in very small areas. The objection will be made that hydrographic and meteorological conditions change rapidly near the coast, but remain constant on the high seas. I doubt the validity of such an objection. In the first place, owing to variations in wind, rain, light, barometric pressure, heat, &c., it is very improbable that hydrographic and meteorological conditions even approach constancy on the high seas. In the second place, some of the above examples show that *S. bipunctata* varied in abundance even when these conditions, so far as known, remained constant during the period within which the contrasted hauls were made."

The author finds himself in agreement with similar observations that have been taken in recent years in the Irish Sea, and comes to the conclusion that "we are therefore compelled to acknowlege a very definite causal relation between rate of reproduction and variations in the quantity of plankton." He discusses the influence of other organisms on the abundance of plankton, and illustrates it by the effect of "red-water," due to the presence of enormous numbers of the dinoflagellate Gonyaulax, and recognises, consequently, that to estimate adequately the quantity of plankton in a given area of the sea we must consider far more than the physical and chemical conditions, and must not omit the biological influences involving the effects of growth, reproduction, food-relations, and other activities of the organisms concerned. As Kofoid (1903) has demonstrated, there are variations in the quantity of plankton which are nearly, if not entirely, independent of hydrographic and meteorological conditions.

Mr. Michael shows that *Sagitta bipunctata*, the commonest species that he deals with, is "epiplanktonic," and, moreover, migrates towards the surface at night and into deeper zones in the day. In the surface-nets this species attains its morning maximum within an hour after sunrise, and its evening maximum within an hour after sunset. He considers that it is probable that the species in its diurnal migrations is constantly moving towards that zone of water in which "twilight conditions" are to be found. The effects of salinity and temperature are also investigated in detail, and the conclusion that our author arrives at is that "probably light has more pronounced effect on vertical distribution than temperature or salinity, because its variations are more regular and periodic."

It is interesting to find that in a later paper in the same series from the University of California, viz., C. O. Esterly on the distribution of the Copepoda of the San Diego region, precisely the same general conclusions as to irregularity of distribution of the plankton are arrived at. In speaking of the absence of any uniformity, the author of this later paper says: "Instances of this could be given almost without number in regard to the distribution of the Copepoda of this region." The marine biologists of the Californian coast are clearly to be congratulated on the thoroughness with which their investigations are being carried out, and on the sound conclusions at which they are arriving. W. A. H.

PROF. FRANCIS GOTCH, F.R.S.

THE phenomena of life and their cessation at death present varied interests attracting to their investigation minds of very diverse type. Thus when the foremost ranks of physiology show a new-made gap, and a distinguished service of some one particular kind is at an end for ever, the loss to the science is not readily repaired. It is then too clear that the gifts which have vanished have differed from those that are left more than in degrees of excellence. Thus deeply at the present time physiology suffers by the death of the late Prof. Francis Gotch. His name is significant of a world-wide reputation. His personality was obviously individual, and in its peculiarities excellent.

Nothing that can be said in the near future can add to or detract from his established reputation. A master of the technique in one particular line, his measurements stand until that technique undergoes unforeseen developments and improvements. In that branch of the subject which he had made his own he had contributed to knowledge a long series of very precise data, placed with great skill at points of salient interest. Feeling no need for the incentives provided by explanatory hypotheses, testing no particular form of speculation, he has patiently and with great ingenuity assisted in a fundamentally essential survey of the physical evidences of life as studied in nerve, muscle, the retina, the special organs of electrical fishes, and in the central nervous system. Further than this, he was a distinguished authority upon the literature of this subject, and a writer of valued summaries and lucid historical articles.

Judged from his writings, he was what I have thus too briefly stated, namely, a dispassionate contributor, and a cold analyst, of evidence. Strange as may seem the contrast, to his students he was a magician, a marvellous weaver of deft

words, a master of dramatic effects, who, with a sure hand, shaped before their eyes a brilliant texture of knowledge, ending always by laying down a finished carpet on which they might walk with reposeful security towards their own looms. His excellence in teaching the general groundwork of the subject was unique. Backed, as it was, by admirable practical classes, in which the niceties of technical skill required for the collection of evidence were instilled, and a whole field of evidence of a particular type displayed, it provided an educational basis of unsurpassable value. No one acquainted with his work will scent exaggeration in the statement that in this matter he was superb.

Outcome as this excellence was, in part, of unstinted effort and elaborate pains, and of a fully-developed desire to satisfy a genuine ambition for success in such teaching, it was also largely the result of native temperament and talent. A cheerful and courteous man, kindly to the core, generous to a fault. Humble with a knowledge of his own limitations, reverently serving undiscussed ideals, alight with enthusiasm. Of wide sympathy, singularly well-informed, of great culture, and most refined taste. Qualities such as these, and an evident sincerity in his devotion to his subject, necessarily won home to receptive and humane minds.

If at any time his manner caused irritation, then I take it this may be attributed to an excellent and uncommon quality, which was at times of great public service. He was essentially æsthetic, exquisitely sensitive to every light and shade in the inanimate, and in the animate character of his surroundings necessarily seeking harmonies, and as necessarily, therefore, arranging them. Neither inviting admiration nor in any way impelled towards dominance, nevertheless he was always quietly to the front to make certain that the scene was set, the players grouped, and a satisfying *ensemble* produced. Wherever such initiative was welcomed, as often in social matters where it is most rare, he was admirably successful. Arriving in Liverpool in 1891 as the first occupant of the newly endowed Holt Chair of Physiology, the complete sincerity of these qualities enabled him to give invaluable support to those able men who were then watchfully tending the growth of the university spirit within its boundaries. There, with his wife, he gained a great social success without underlying thought other than to give his best, and to obtain the best from others. His accomplished predecessor, citizens of great importance and benevolence, colleagues and students, he turned into grateful friends not of himself alone, but into mutual friends. That he was so signally capable of assisting in an obviously large and progressive movement, the development of university ideals of freedom in thought, in work, and in teaching, within a great and typical centre of commercial industry, must have had a reflected influence on his own character, and given him an added courage and skill in dealing with public affairs.

Leaving Liverpool in 1895 to occupy the Waynflete Chair of Physiology in Oxford, he returned to scenes already familiar. He was frankly pleased with this great and different opportunity; thinking it no small thing that he was entrusted with the banner carried so loftily by his distinguished master, whose influence had been largely responsible for the shaping of his career. If it is right to regard as ambition the desire to win complete recognition in a life-work not chosen from motives of dominance or gain, then it was his ambition which was now completely satisfied. In return for this satisfaction he endeavoured to perform the duties of this post of honour with anxious care and unflagging industry, shirking no responsibility. That he has proved equal to the task is evident from the continued success of the Oxford school of physiology, and from the value and numbers of its alumni who have passed out into, and maintain with credit, positions of great importance.

To his personal friends who have tramped through the mists of Cumberland fells, or wandered through the picture galleries and churches of foreign towns, with a companion so brimful of cheer and interest, or who have heard him tell the tale of his one participation in a cavalry charge in Zululand, or have listened to his renderings of Devonshire songs, his death has brought an intimate sense of loss.

To his wife and family, the centre of so much mutual love and understanding, we can do no more than offer sincere sympathy.

J. S. MACDONALD.

NOTES.

DR. R. VON LENDENFELD, professor of zoology and rector of the German University of Prague, who died on July 3, aged fifty-six, had many friends and acquaintances in this country, where he resided for a time. He began his scientific career by travelling in Australia, where he studied chiefly marine sponges and cœlenterates. The results of his investigations were published, partly in English, as "A Monograph of the Australian Sponges," and other papers in the Proceedings of the Linnean Society of New South Wales, and partly in German, as a series of memoirs, entitled "Ueber Cölenteraten der Südsee." After his Australian trip he was for a time assistant in the zoological department at University College, London, and while in England produced, besides other works, his "Monograph of the Horny Sponges," published by the Royal Society, based chiefly upon material collected in Australia. Much of his earlier work was somewhat Haeckelian in the method of treatment, and later investigation has failed to confirm the accuracy of many of his statements, notably the existence of a nervous system in sponges alleged by him. Subsequently he published some works on sponges jointly with Prof. F. E. Schulze, of Berlin, and later, after he obtained the chair of zoology at Czernowitz, he published a monograph of the sponges of the Adriatic in a series of memoirs. When called to Prague he continued to publish, from time to time, systematic

monographs upon the sponges collected by various expeditions. In addition to his zoological work he was a keen mountaineer, and contributed articles to various Alpine journals.

THE Dogs (Protection) Bill, which has for several weeks been before a Standing Committee of the House of Commons, but reached a deadlock on July 16, provides that it shall be unlawful to perform any experiment of a nature likely to cause pain or disease, with or without anæsthetics, upon dogs. The Bill would thus prevent, in this country, all experiments on dogs, not only all experiments under anæsthetics, but all inoculations. We may all of us be agreed that a dog has more claim on our regard than a rat or a guinea-pig; but we have to consider whether the Bill, in the long run, would lessen the sum of pain, disease, and death, in the world; and the answer surely is that it would not. Indeed, it would inflict far more than it would avert. For it would hinder in this country the proper and complete investigation, not only of human diseases, but also of canine diseases. Among human diseases, it would hinder the study of diabetes, and perhaps of kala-azar and of cancer. Looking back a few years, we can say that the Bill would have prevented, if it had been in existence, the discovery of the best vaccine against distemper in dogs, and the best treatment of malignant jaundice in dogs. Looking forward, we cannot foresee what the Bill would be preventing; but all experience goes to show that it would be preventing work useful either to man or to dogs. Experiments on dogs in this country are jealously restricted already by the Home Office; and the Bill is a move in the wrong direction. Some useful pamphlets on this subject can be had on application to the Research Defence Society.

MR. L. W. KING, assistant in the Department of Egyptian and Assyrian Antiquities in the British Museum, has been appointed to the post of assistant-keeper in that department.

CAPT. P. J. MARETT has been appointed to a Beit Memorial Research Fellowship to carry on further research as to the nature of the virus of sand-fly fever, a disease which is the cause of much sickness in the ships of the Mediterranean Squadron and among the troops stationed at Malta and in certain parts of India and elsewhere. The Army Council has approved of Capt. Marett, who has already published several papers on the subject, undertaking this research in addition to his military duties at Malta.

THE council of the Royal Society of Arts attended at Buckingham Palace on July 18, when his Royal Highness the Duke of Connaught, president of the society, presented to his Majesty the King, for nine years president and now patron of the society, the society's Albert medal for the present year, "in respectful recognition of his Majesty's untiring efforts to make himself personally acquainted with the social and economical conditions of the various parts of his Dominions, and to promote the progress of arts, manufactures, and commerce in the United Kingdom and throughout the British Empire."

THE Institution of Mechanical Engineers will meet at Cambridge on Tuesday, July 29, and Wednesday, July 30, in the Senate House of the University. The papers to be read and discussed are:—A new method of cooling gas-engines, Prof. Bertram Hopkinson; modern methods of measuring temperature, R. S. Whipple; modern pumping machinery for the drainage of the fens, R. W. Allen; the drainage of the fens, R. F. Grantham; the drainage of the River Ouse basin, E. G. Crocker; modern flour milling machinery, R. B. Creak; and a few notes on engineering research and its coordination, G. H. Roberts.

A SCHEME for the establishment of an Oriental Research Institute in India has been put forward tentatively by the Government of India, with a suggestion that an expression of the views of the provincial Governments be invited. Meanwhile the Royal Anthropological Institute has taken the opportunity of addressing the Secretary of State with a plea for the inclusion of anthropology in the course of studies at the institute. In his reply the Secretary of State observes that he is alive to the importance of anthropological research, and thanks the institute for its offer of cooperation, which is being conveyed to the authorities in India. But he points out that in the present state of the question it would be premature to discuss the exact scope of the proposed Research Institute.

WE understand that excavations in the base-beds of the Red and Coralline Crags of Suffolk have now been proceeding for some months under the direction of Mr. J. Reid Moir. Worked flints of various forms, consisting of the well-known rostro-carinate type, pointed implements for use in the hand, pounders, rubbers, round-ended and other scrapers, borers, hammer-stones, and flakes, affording evidence of a complete sub-Red Crag "industry," have been recovered. Extensive diggings at various sites have brought to light a small but very excellent series of humanly flaked flints, some of which have barnacles of the Red Crag Sea attached to their worked surfaces. With the exception of one small ridged flake, no humanly struck flints have as yet been found beneath the Coralline Crag.

THE KING has recently placed on loan for exhibition at the British Museum a large and valuable collection of gifts received by him from the Dalai Lama of Tibet. It includes a very sacred relic, a royal saddle, said to be 500 years old, and used by the first Dalai Lama who entered Lhasa; a set of Tibetan armour with a steel helmet, the armour being of a type spread over western Asia; a fine sword of the shape still used by the Khambas, the most warlike Tibetan tribe, which was probably made at Derge, and exhibits remarkable handwork. Tibetan Buddhism is represented by seven gilt images of the Seven Gems, which have been fully described by Dr. Waddell in his classical work, "The Buddhism of Tibet," and the Eight Glorious Emblems and Offerings. Among smaller objects is a model of a Chor-ten or shrine, charm-boxes, and a complete costume of a Tibetan lady, the gown of bright colours on a dark purple-brown ground, the boots of green and red cloth, embroidered in green and red.

THE new Natural History Department of the Birmingham Museum and Art Gallery was formally opened on July 17 by Alderman W. H. Bowater (Deputy Lord Mayor), in the absence of the Lord Mayor through illness. The museum, which forms a part of the Council House extension, is situated on the upper floor of the building facing Congreve Street, and comprises four galleries, one of which is not yet opened, having been reserved for the Beale Memorial collection, which is to consist of nesting groups of British birds. The collections, which have been arranged by Mr. W. H. Edwards, contain representatives of most sections of natural history, and though birds, shells, and insects predominate at the present time, the committee hopes now the museum is started that generous donors may be forthcoming to supply some of the deficiencies. An interesting feature is a large case arranged on somewhat original pictorial lines, and illustrating a British marine topographical group. Sea-birds, some with their eggs, are mounted on a large rock, others are shown in flying positions, whilst the lower portion of the case represents a depth of 18 in. of sea-water, in which various fishes, an octopus, cuttle-fish, crabs, lobsters, &c., are shown as in a state of nature amongst seaweeds or resting on the sandy bottom. Special mention must be made of an extremely fine collection of British birds, including many very rare species, arranged in cases with their natural environment, and in various states of plumage. These have been lent by Mr. R. W. Chase, and occupy the whole of one of the galleries.

APHIDES form the subject of the two chief articles in the July issue of *The Journal of Economic Biology*. In the first Prof. F. V. Theobald reviews the British representatives of the genus long known as Siphonophora, or Nectarophora, but for which the author employs the earlier title, Macrosiphum. Inclusive of twelve described as new, the British list comprises fifty-five species. In the second article Mr. T. R. Hewitt records the occurrence of a woolly aphis (*Schizoneura lanigera*) in the core of an apple, and suggests that such infestation may occasionally assist the dissemination of the species.

ACCORDING to the July number of *The Entomologist's Monthly Magazine*, the greater part of the magnificent collection of butterflies and moths (including hundreds of type specimens) formed by the late Mr. Herbert Druce has been acquired by Mr. J. J. Joicey, of The Hill, Witley, Surrey. The representatives of the Lycænidæ and Hesperiidæ have, however, been retained by Mr. Hamilton Druce, and Mr. Druce's first collection of butterflies is now in the Natural History Museum. In communicating this information Mr. Joicey states that his portion of the collection is available for study to entomologists.

IN *Spolia Zeylanica* for June Mr. E. E. Green describes, with coloured illustrations, a case of mimicry by spiders of the genus Cœnoptichus of the wingless forms of wasps of the family Mutilidæ, including those of the type genus. The general effect of the resemblance is most striking, the cephalo-thorax of the spiders having the red dorsal surface characteristic of many of the wasps, while in both groups the abdomen is conspicuously spotted with white or yellow. The spiders belong to one species, but mimic the whole group of wasps, and not any particular kind, protection being doubtless the object of the resemblance. Other Ceylon spiders belonging to the same family (Attidæ) mimic ants.

IN *The Field* of July 12 Mr. Boulenger directs attention to the description by Mr. P. A. Ouwens in the *Bulletin du Jardin Botanique de Buitenzorg* for 1912 of a gigantic monitor lizard from the Isle of Comodo, between Flores and Sumbawa. The type specimen, described as *Varanus komodensis*, measured 7 ft. in length, but a second example is reported to have reached 13 ft., and there are stories of others with a length of from 19 ft. to 23 ft. The species appears to be related to the North Australian *V. giganteus*, which grows to 7 or 8 ft., but it has the muzzle less pointed and brown in colour, while the tail is proportionately shorter. That this giant of its tribe is distinct from all the other living representatives of its genus is certain; but Mr. Boulenger suggests that it may prove to be inseparable from *V. priscus*, of the Pleistocene of Queensland, the vertebræ of which appear to indicate a reptile at least as large as the biggest reported individuals of the Comodo monitor.

THE latest publications of the Fisheries Branch of the Department of Agriculture and Technical Instruction for Ireland include a paper by Messrs. E. W. L. Holt and L. W. Byrne, on the fishes of the Irish Atlantic slope. Some species belonging to the families Stomiatidæ, Sternoptychidæ, and Salmonidæ are described and figured. The same part of the report also contains a paper by Mr. C. L. Boulenger on the luminous organs of the stomiatid fish, *Lamprotoxus flagellibarba*. Mr. R. Southern, in a further report, describes a collection of Gephyrean worms from the coasts of Ireland. Twenty-three species in all are recorded, and six of these are described as new to science. Five species are added to those previously known to exist in the British area. The author advances reasons for regarding *Golfingia macintoshii* of Lankester as synonymous with Blainville's *Phascolosoma vulgare*, and *Thalassema lankesteri* of Herdman as synonymous with Müller's *Thalassema gigas*.

PROF. O. SCHMEIL'S "Naturwissenschaftliches Unterrichtswerk" series has enjoyed an extraordinary vogue in Germany, and when recently revising the botanical portion of the series the author found it necessary to omit certain branches of the subject in order to avoid undue extension of the general botanical volume, intending to write a special work on foreign economic plants. This has now appeared as a separate volume by L. Oberwalter, "Ausländische Kultur- und Nutzpflanzen" (Quelle and Meyer, Leipzig, price 2.40 marks), with an introduction by Prof. Schmeil. This book, uniform in plan with the other volumes in Schmeil's well-known series of manuals, is illustrated by fifty-nine figures, and forms an excellent introduction to economic botany.

ONE of the most important and difficult questions in connection with the maintenance of railways in India is the supply of suitable sleepers, and in a

recent issue of *The Indian Forester* (vol. xxxix., No. 4) Mr. R. S. Pearson discusses the reasons why the forests of India, covering about 25 per cent. of the country, cannot apparently at present fully meet the demands of the railway engineers, who seem inclined to fall back on iron in default of a supply of suitable wood. On the railways running through the desert tracts, with climate ranging from severe frosts in winter to fierce dry heat in summer, and salt winds laden with sand, iron sleepers have proved unsatisfactory, since all kinds of iron become spongy under such conditions, and wooden sleepers last much longer. With the extension of railways in India the demand for sleepers is increasing, and for lack of suitable native wood large quantities of the Australian hardwoods have been imported during recent years; these answer fairly well in the damp climate of Bengal, but elsewhere have failed owing to inability to resist the attacks of white ants. The best sleeper wood in India and Burma is teak, but this is now used for other purposes, for which a much higher price can be paid, and Indian foresters are devoting considerable attention to the whole question of a suitable timber or timbers, and the equally important matter of suitable treatment to make the wood more resistant and durable.

IN the June number of the Journal of the Board of Agriculture, Dr. Winifred E. Brenchley gives a survey of a season's work on weeds and their relations to the soils of Norfolk. Compared with results of similar work in Bedfordshire and the western counties, a greater number of species was observed in Norfolk, and this is attributed partly to greater diversity of the Norfolk soils (which are of drift origin) and partly to the larger area covered by the investigation. Some of the weeds are proving to have a real association with different types of soil, while others show decided local differences. The relative richness of sand and sandy loams in calcium carbonate is reflected in the flora, such "acid" plants as Rumex and spurrey never being found on these soils. Few species have a decided preference for heavy land, and practically none can be designated as absolutely symptomatic of clay, though a few are certainly characteristic; of these the chief are field foxtail, cut-leaved geranium, hogweed, and corn crowfoot. The occurrence of certain weeds with definite types of crop was also observed.

THE Bulletin of the Philippine Weather Bureau for October, 1912 (recently received), contains particulars of four typhoons in that month, three of which crossed the archipelago. The most noteworthy was one which passed over the Visayas, or central group of islands, on October 15 and 16, and named the Leyte and Cebu typhoon. As the observations from Yap (Western Carolines) gave no indication of its existence it is supposed to have originated rather near the Philippines, probably about long. 132° E., lat. 10° N.; the Manila Observatory was, however, able to give timely warnings of its approach. The Rev. J. Coronas, S.J. (assistant director), states that the storm must be classified as one of prime importance, both on account of the lowness of the barometer in the neighbourhood of the vortex, 707 mm. (27·84 in.), and the consequent violence of the winds (seventy to eighty miles an hour), as well as on account of the torrential rains which caused inundations, more particularly in the south of Leyte and north of Cebu. All towns within a radius of twenty miles from the storm centre describe their losses as incalculable, and several interesting photographs are given showing the destructive effects of the typhoon. The great loss of life in Cebu is partially due to the facts (1) that little attention was paid to the warnings, and (2) that the vortex passed near midnight, whereas in Leyte it passed during the daytime.

The Electrician for July 4 contains a description of a method devised by Mr. G. B. Burnside for sealing metallic conductors, *e.g.* copper into glass directly. The essential feature of the method consists in the repeated immersion of the glass and metal, immediately the fusion in the usual way has been effected, and the glass has cooled to a red heat, into a slightly heated bath of oil or fat for a second or two, the extent of the immersion being increased each time. For currents up to 15 amperes solid conductors may be used, but above that it is advisable to fuse in tubular conductors. The author has experienced no trouble with these joints, and has found that a copper tube capable of carrying 100 amperes fused into glass in this way may be heated to 100° C. without the joint showing any signs of deterioration. The method solves a difficult problem, and obviously has a wide range of applications.

TWO recent Memoirs of the College of Science and Engineering, Kyoto Imperial Observatory (vol. iv., Nos. 1, 2), show that the Japanese are prepared to follow up their previous excellent work in connection with geodynamics and latitude variation by some other thorough-going researches. The volume for which Prof. Toshi Shida is mainly responsible, contains an interesting account of preliminary horizontal pendulum experiments conducted at the Kamigamo Geophysical Observatory. The results of these experiments so far confirm the larger value for the effective rigidity of the earth found by Herglotz from the Chandler period of free nutation. This is about twice the value derived from the results of tidal observations and deflections of the plumb-line. Hecker's Potsdam observations have been analysed by Messrs. Shida and Matsuyama for the lunar diurnal term. The results confirm the idea that Hecker's observations, at any rate for one pendulum, were either seriously affected by some local disturbance (*e.g.* pumping in the well) or else represent some abnormal behaviour locally of the earth's crust. Another interesting communication from Prof. Shida is his discussion of volcanic tremors. His attempt to deduce the Chandler period from the time distribution of volcanic eruptions is interesting if not convincing. It gives the value 431·45 days. The *z*-term in the variation of latitude—or the Kimura term as it is known in this country—comes in naturally for discussion in a Japanese memoir. Prof. Shinzo Shinjo enters into a careful discussion of possible physical explanations, and ascribes it to anomalies in zenithal refraction. In this view he is in agreement with Dr. Frank E. Ross. Without being able to give any accurate numerical result, he

suggests that in periodic changes in the refraction may be found in part the explanation of the discrepancy between the values of the aberration constant derived from the solar parallax and that given by Talcott's method. Further work can alone elucidate the point.

Engineering for July 18 gives an account of investigations made by the United States Bureau of Mines on the ignition of mine-gas by glow-lamps. That all types of glow-lamps are not equally liable to cause ignition of explosive gas was known from previous experiments, conducted chiefly in Belgium, France, and Germany. The American investigators come to the following chief conclusions:—The naked carbon filaments of standard types of lamps, burning at rated voltages, will invariably ignite explosive gaseous mixtures. If the gas can reach those filaments without breaking them, or without producing partial combustion within the bulbs, the gas is sure to be ignited. Several, but not all, sizes of standard lamps (carbon and metallic filaments) and of miniature lamps (small lamps for miners) will ignite the gas when smashed while burning at rated voltages; those lamps which do not cause ignition usually, may do so if the broken pieces of the filament produce a short circuit when the lamps are smashed. Reviewing the results, all the lamps tested must be considered unsafe, though some specimens of a class might not cause ignition. Alternating or direct current, and coupling in series or parallel, made little difference.

MESSRS. J. and A. CHURCHILL have nearly ready for publication the seventh edition of "The Microtomist's Vade-Mecum," by A. B. Lee; the sixth edition of the late Prof. J. Campbell Brown's "Practical Chemistry," edited by Dr. Bengough; and the third edition of "A Text-book of Physics," edited by A. Wilmer Duff.

THE publication of a new series of books, entitled "The Cambridge Technical Series," and edited by Mr. P. Abbott, is being undertaken by the Cambridge University Press. The series will be comprehensive and will include the whole sphere of technical work in the widest sense. Among the subjects arranged for are:—Automobile engineering, electro-technical measurements, chemistry and technology of oils and fats, mining geology, and domestic science.

A COPY of their new list of wireless apparatus and accessories has been sent to us by Messrs. F. Darton and Co., 142 St. John Street, Clerkenwell, London, E.C. This firm has a long-distance installation at work at its factory, and makes a practice of explaining the most efficient methods of using the apparatus supplied to customers. The list is well illustrated, and full particulars of many forms of transmitting and receiving apparatus are supplied.

OUR ASTRONOMICAL COLUMN.

PERIODIC SPECTRUM OF α CANUM VENATICORUM.—Prof. A. Belopolsky publishes in *Astronomische Nachrichten*, No. 4664, the epochs of maximum intensity of the dark line $\lambda=412{\cdot}993$ $\mu\mu$ in the spectrum of α Canum Venaticorum. Fifty hours is stated to be the length of time of the visibility of this line, and the periodicity very near 5·50 days. Other lines become faint at these epochs.

1913	July	24·96	G.M.T.		Aug.	15·96	G.M.T.
	,,	30·46	,,		,,	21·46	,,
	Aug.	4·96	,,		,,	26·96	,,
	,,	10·46	,,		Sept.	1·46	,,
					,,	6·96	,,

STARS HAVING PECULIAR SPECTRA.—The observations carried out by Miss Cannon for the Revised Draper Catalogue have added already ten stars to those known to have bright lines in their spectra, and twenty-four new composite spectra. Details of these are given in Harvard Circular 178. The bright-line stars have spectra belonging to classes ranging between B3 and Oe. The latter shows the bands λλ4633 and 4688 bright, whilst Hβ is seen bright in the rest, one also showing Hγ as a bright line. Of the twenty-four stars showing composite spectra only four are included in Burnham's General Catalogue of Double Stars.

In the same circular it is remarked that a photograph of the spectrum of Nova Geminorum No. 2 secured on April 5, 1913, shows only slight changes since November 9, 1912, when the brightest band was at λ4363. Between λλ4686–5007 the spectrum resembles that of the prevailing type of gaseous nebulæ, but differences occur in other portions of the spectrum.

THE ORIGIN OF THE PLANETS.—In a memoir communicated to the American Academy of Arts and Sciences (vol. xiv., No. 1) Prof. P. Lowell arrives at some interesting conclusions regarding the genesis of the solar system. Inquiring into the causes of a striking commensurability exhibited between the mean motions of adjacent planets some of the deductions he makes are:—(1) The planets grew out of scattered material; (2) each brought the next one into being by the perturbation it induced; (3) Jupiter was the starting point, and is the only one of the planets that could have had a nucleus at the start.

Prof. Lowell enunciates the following law:—"Each planet has formed the next in the series at one of the adjacent commensurable-period points, corresponding to $\frac{1}{2}$, $\frac{2}{3}$, $\frac{1}{3}$, and in one instance $\frac{3}{5}$ of its mean motion, each then displacing the other slightly sunward, thus making of the solar system an articulated whole, an inorganic organism, which not only evolved but evolved in a definite order, the steps of which celestial mechanics enables us to retrace."

On the basis of this law he makes some predictions regarding "the nearest trans-Neptunian planet"; thus it should have a major axis of 47·5 astronomical units, and a mass comparable with Neptune, though probably less.

THE HULL MEETING OF THE MUSEUMS ASSOCIATION.

THE annual conference of the Museums Association was held at Hull last week, under the presidency of Mr. E. Howarth. There was a large attendance, including representatives from abroad, as well as from numerous places in the British Isles.

As his presidential address, Mr. Howarth gave a helpful and suggestive discourse on the scope, function, and development of museums, using the word in its most comprehensive sense. He pointed out that though the universe could not be represented in a museum, yet even the provincial institution was doing work of a national character. It would be foolish to attempt to reproduce the British Museum in every town, but the principles dominating it were applicable to the smallest village museum. Museums should

hold a recognised position in the scheme of national education from its base to its summit, and each museum, whether its teaching be general or specific, should do more than merely provide object-lessons. It should focus attention upon the progress of human knowledge and achievement. This cannot be done by punishing the visitor with endless series of specimens of interest only to the specialist. It must be accomplished by selecting a strictly limited number of objects, and so displaying them as to endow them with an intensely human interest. The gathering together of objects of local significance should be the primary duty of the curator, and their effective display his greatest achievement.

In a paper entitled "Methods of Collecting," Mr. T. Sheppard gave a brief account of the growth of the Hull museums. As evidence of continued development it may be mentioned that at the association dinner it was announced that Colonel G. H. Clarke had determined to purchase and present to Hull the Mortimer collection of prehistoric antiquities, geological specimens, and other relics, at present housed in the museum at Driffield. The announcement was received with the greatest enthusiasm, for the collection is renowned as one of the best series of Yorkshire prehistoric antiquities in existence, and its value is enhanced by the careful and scrupulous records kept by Mr. Mortimer.

The most novel paper of the conference was probably that given by Mr. J. A. Charlton Deas, of Sunderland, "How to Show our Museums and Art Galleries to the Blind." In essence this was a report of experiments made by Mr. Deas at the Sunderland Museum and Art Gallery, where demonstrations have lately been given to parties of blind people, both adults and children. Blind visitors in the museum were taken in hand by guides. They handled certain specimens, and each feature was explained at the moment of touch. Attached to each specimen was a carefully drawn-out descriptive label, which was read by the guide, and great care was taken in leading the hands or fingers of the blind to the important features. Mr. Deas emphasised the need for conscientious guiding of the blind person's hands, and said that where possible there should be a guide for each blind visitor. The blind children of the council school were also taken in this way through the museum and art gallery. Some remarkable models were made, after the examination of the specimens, by children between eight and fifteen years of age, none of whom had any special knowledge of modelling. In fact, in some cases they were a first attempt. The models, though rough, showed in many cases remarkable spirit.

Prof. Roberts Beaumont, of Leeds University, read a paper upon the organisation of a textile museum, in which he said that the subject, though a large one, had not received that full attention which those connected with the textile arts considered it should have. He insisted upon the importance of illustrative models being technically correct, and effective for the demonstration of the purpose and function for which the machines were originally invented. Nor is it enough to furnish the student with specimens illustrating the history of textile ornament. Such analyses should accompany the specimens as would make them increasingly suggestive to those who viewed them and increasingly inspiring. A textile museum should set forth the history of manufacture and the process and sequence of invention, typifying the nature, scope, and function of each department of the industry, exemplifying each phase of woven art, stimulating research, and proving a veritable storehouse of classified knowledge.

Mr. J. W. Baggaley described a simple and efficient gelatine and glycerine cement by means of which he had been able to mount zoological specimens in spirit.

The association was honoured by the presence of Prof. F. Rathgen, chemist to the Royal Museum at Berlin, whose experiments and writings on the treatment and preservation of antiquities are so well-known to all curators. He gave a paper on the decay and preservation of antiquities, which aimed at giving an outline of the various causes underlying the disintegration of antiquities after excavation, due to the changes which have taken place during varying periods and conditions of interment.

Mr. Cecil W. C. Hallett and Mr. J. H. Leonard, official guides at the British Museum, Bloomsbury, and the British Museum (Natural History), South Kensington, gave accounts of their personal experience in conducting parties of visitors around these great national institutions. Arising out of this experience they were able to give many valuable hints as to the precautions to be taken to ensure successful and enjoyable demonstrations. Some of the difficulties which present themselves—such as noise, interruption from visitors not belonging to the party, &c.—were admittedly difficult to remedy, but, as public appreciation and the powerful advocacy of such friends of museum work as Lord Sudeley seem destined to bring this mode of spreading knowledge of our potentialities into vogue, it is essential that they should be overcome.

Mr. Reginald A. Smith, of the British Museum, gave a paper on curators and the Stone age. He directed attention to the fact that Britain was rapidly showing itself to be a much richer field for discovery in this direction than we have hitherto believed, and that the subject has now attained such public prominence as to call for close attention on the part of the curator. Stone-age archæology may now be described as being in the melting-pot, and it is our duty to see that we assimilate the new and far-reaching ideas which emanate therefrom.

The paper part of the meeting concluded with some interesting remarks by Dr. F. A. Bather, F.R.S., on fittings and preparations noted during a recent visit to the museum of the Institut Océnographique at Monaco, and a message from the Rev. Prof. Henry Browne emphasising the need for assistance from museums in the furtherance of classical studies.

The business meeting had several matters of special interest to consider, foremost amongst which was the question of grants by the Board of Education in aid of the purchase of scientific specimens for provincial museums. These grants have been in abeyance for several years, but the advisory council for the science museum has now taken up the matter, and a sub-committee recently received a deputation from the association in a most understanding and sympathetic spirit. The outcome is that the Museums Association has been asked to submit its views as to the direction in which grants would be helpful and appropriate, and as to the conditions which should accompany them.

The following resolutions were passed:—

"That this association desires to direct the attention of the Board of Education to the great value to provincial museums of the collections sent out by the Victoria and Albert Museum, and trusts that, now that the circulation department has been made a self-contained section of the museum, with no power to circulate any of the specimens in the general museum, the collections available for circulation will be augmented to meet the requirements of the provincial museums, which steadily increase in number, and are undoubtedly attaining a higher level of artistic excellence."

"The Museums Association, at its annual conference in Hull, 1913, declares itself in cordial sympathy with the proposal to make provision in the grounds of the Crystal Palace for a British Folk-Museum on the open-air plan, and expresses the hope that the Right Hon. the Lord Mayor of London will use every endeavour to carry the proposal into effect."

The conference concluded its business by electing Mr. Charles Madeley, director of the Warrington Museum, to be president for the 1914 meeting, which is to be held at Swansea.

THE ELECTRIC FURNACE SPECTRUM OF IRON.

IN NATURE for April 24 (p. 200) we gave a brief account of the researches carried on by Mr. A. S. King, of the Mount Wilson Solar Observatory, upon the variations of the spectrum of titanium in the electric furnace. Mr. King has now concluded an investigation of the variation with temperature of the electric furnace spectrum of iron, an account of which is published in No. 66 of the Contributions from the Mount Wilson Solar Observatory.

This communication, like others of his on a similar subject, is of great interest, because it shows that the spectrum of a substance is not the same for any temperature. By knowing what spectrum is given at a known temperature it is possible to determine the temperature of stars or portions of the sun, and so utilise these laboratory researches for stellar and solar spectroscopy.

While a great amount of work has already been done in the case of iron, one of the earliest being the differentiation of temperatures by the short- and long-line method of Lockyer, Mr. King has all the advantages of the latest form of furnace and method of determining accurately the varying temperatures for the lower stages of temperature.

One of the great problems in these investigations is to determine whether the changes described are due to temperature or to electrical or chemical conditions which are present in different degrees in the sources of heat.

In a brief summary like this it is not possible to state all the conclusions which the research has led Mr. King to deduce, but the more important may be briefly summarised. In the first place, he has been able to divide into six classes the relative intensities of the iron lines in the visible spectrum for three furnace temperatures and the arc, basing them on the temperature at which a line appears in the furnace, and its rate of growth as the temperature increases. In passing from the furnace to the arc the changes in relative intensity may generally be accounted for by a difference in conditions equivalent to a large temperature difference. The ultra-violet was found a rich region for lines, and it was noted that increase of temperature corresponded to an extension of the line spectrum towards shorter wave-length. The increase in intensity of lines from the outer vapours into the core of an iron arc was found usually to resemble the rate of growth shown by the same lines with rising furnace temperature, and this the author suggests renders it unlikely that chemical reactions in the outer vapours affect the relative intensity of arc lines in any large degree.

So far as the visible region is concerned the enhanced iron lines are above the furnace stage, no lines being observed in the furnace spectrum. The furnace spectra at low and medium temperatures were found, except perhaps in the ultra-violet, to be very similar to those of the several flames.

The author concludes that while there is no definite proof that temperature radiation in a strict sense takes place, the position of temperature as the exciting and regulating agent in furnace phenomena seems to be clear.

ANTARCTIC LICHENS.[1]

LICHENS form a quite exceptional group of plants with many peculiar features, the chief among which is the fact that they are compound organisms, a lichen consisting of a fungus individual and numerous alga individuals—the fungus with its branched and interlacing threads has grown around the alga cells and enclosed them in a nest. The result is that the lichen can grow in places which would be quite unsuitable for the independent existence of either the fungus or the alga of which it is composed. Algæ grow in water or in moist places, while most fungi are extremely sensitive to cold and drought, but lichens can thrive in the bleakest positions and in the most severe climates, as on bare mountain rocks and in the farthest circumpolar regions reached by explorers—provided that the land surface is not covered by perpetual snow. In alpine and arctic regions, lichens do important pioneer work, helping to break up the hardest rock surfaces and prepare soil on which other plants can grow; while on steeply inclined and bare rock, lichens, along with minute algæ, are in general the first colonists.

These pioneer lichens are of the flat crustaceous and foliose types, the former attached closely to the substratum by their entire underside, the latter clinging more loosely, and being therefore detachable without chipping off bits of the rock itself in order to obtain specimens. On less steeply inclined parts, where the vegetation is older, the shrubby or fruticulose lichens are added; these are fixed at the base only, and show much greater variety of form than is found among the encrusting and leafy types.

In his report on the lichens of the Swedish Antarctic expedition, 1901–3, under Dr. O. Nordenskjöld, which has recently been published, Dr. O. V. Darbishire adds to his descriptions of the new species an interesting summary and discussion of the distribution of lichens in the arctic and antarctic regions generally. Unfortunately the good ship *Antarctic* was crushed by ice in January, 1903, and a large portion of the plants collected during her cruise along the coast of Graham Land had to be abandoned when she sank a month later; but though doubtless a considerable amount of material was lost in this disaster, a rich harvest was brought back by the botanical members of the Swedish expedition. This includes no fewer than 145 species of lichens, of which thirty-three are new.

An analysis of the results of antarctic expeditions up to and including Charcot's (1905) shows that at present 106 lichen species are known from the land which lies strictly within the antarctic limits, and that of these thirty-two also occur in subantarctic America, twenty-five in New Zealand, and sixteen in South Georgia, showing a very close affinity between the antarctic lichen flora, on one hand, and the American and New Zealand floras, on the other—the difference to the disadvantage of the latter being accounted for by the greater nearness of the subantarctic American region to the extreme limit of the southern drifting pack-ice. The lichens of subantarctic America and New Zealand are also very nearly allied, for out of 133 lichens in the former flora, 113 are found in New

[1] "The Lichens of the Swedish Antarctic Expedition." By Otto Vernon Darbishire. Wissensch. Ergebn. der schwedischen Südpolar-Expedition. 1901–1903. Band iv., Lief. 11. Pp. 1—73+3 plates. (London Dulau and Co., Ltd., 1912.) Price 8s. (Subscription price 6s.)

Zealand, 32 in the Antarctic, and 31 in South Georgia, the latter being evidently, from the phytogeographic point of view, a half-way house on the road from subantarctic America to the true antarctic area. Moreover, practically half of the antarctic species are common also to the arctic regions.

Of the 106 antarctic lichens, sixty-nine are crustaceous, eighteen foliaceous, and nineteen fruticulose species; of these, the numbers found in subantarctic America are respectively sixteen, five, and eleven. Of the sixty-seven species found only in the true antarctic area, forty-nine are crustaceous, ten foliaceous, eight fruticulose. The subantarctic American lichen flora includes 366 species, while 740 species have been enumerated for New Zealand; of the species common to the two regions 50 per cent. are fruticulose, 30 per cent. foliaceous, and only 20 per cent. crustaceous. The affinity of the subantarctic American and New Zealand lichen floras lies mainly in the fruticulose lichens, which are the oldest and probably the least variable forms. The encrusting species are more variable and have adapted themselves more readily to local conditions, thus giving rise to new species. An interesting point arises from a comparison with northern lichen floras. The arctic area had nearly 500 lichens, of which 72 per cent. are found in Tyrol. Thus the relation of arctic to alpine lichens is much greater than that of subantarctic American to New Zealand species, indicating that the latter are further from the point of common origin.

Dr. Darbishire raises the interesting question of the resistance of cold by lichens, and suggests some simple experiments which might be made on lichens in the very coldest regions. For instance, it would be of the greatest importance to determine the amount of water contained in the lichen thallus at various times and seasons. In what condition are lichens during the long winter? At what temperature does assimilation commence? It is of little use to try experiments on plants in warmer climates, if we wish to ascertain how these small plants can live under the adverse conditions prevailing in the arctic and antarctic regions.

Lichens are found everywhere on the outer limits of vegetation, and their chief ecological distribution factor is their power to become quite dry and yet remain alive. No doubt it is this property which enables them to spread slowly but surely into the bleakest and most inhospitable regions. They are making their way towards the north and south poles, and so far they have been beaten in their race only by the perpetual covering of snow. There is little doubt that if bare rocks are found in the neighbourhood of the poles themselves, lichens will be found growing there.

Dr. Darbishire's memoir is illustrated by three double plates of beautifully reproduced photographs, depicting the new species brought back by the expedition. F. C.

APPLICATIONS OF POLARISED LIGHT.

ON November 30, 1812, just above 100 years ago, the French physicist Biot communicated to the Institute of France a memoir "on a new kind of oscillation which the molecules of light experience in traversing certain crystals." In this paper, which extends over 371 pages of the printed memoirs, the phenomenon of "rotatory polarisation" was described for the first time. This phenomenon depends on the property which certain substances possess of taking a beam of polarised light and imparting a twist to the plane of polarisation: the beam of light enters with all the vibrations compressed, say, into a vertical plane; it emerges apparently unchanged, but careful examination shows that the component vibrations are no longer vertical, but inclined either to the right or to the left. The importance of this discovery to physicists and to crystallographers was immediately obvious. In our own generation its fertility has been realised also by chemists, who have found in the polarimeter an instrument which promises to render to the science services not less notable than those which have been accomplished with the help of the spectroscope.

[1] Discourse delivered at the Royal Institution on Friday, April 18, by Dr. T. M. Lowry.

A.—*Sources of Polarised Light.*

If one were to ask what progress had been made in the facilities for applying polarised light to the study of chemical and physical problems, the answer would be twofold. On one hand it must be acknowledged that the "Iceland spar," by means of which Huyghens in 1678 first detected the polarisation of light, is still the best substance for producing this effect. But the increasing demand for the spar has not been accompanied by any corresponding increase in the supply, and large clear pieces of the mineral are becoming increasingly difficult to procure. It may indeed be doubted whether large polarising prisms such as those which have been handed down as heirlooms at the Royal Institution could now be purchased at any price, in view of the "spar-famine" which has prevailed for some years.

Considerable advance has, however, been made in the direction of improved methods of illumination. The solar light, which figured so largely in the experiments of the earlier workers, is too precarious to satisfy the ardent worker of to-day, and in any case could render no direct assistance in illustrating a Friday evening discourse. When Faraday, on Friday, January 23, 1846, delivered his discourse on the magnetisation of light to an audience of 1003 persons, the source of light in the experiments which he described was an Argand gas-burner. Prof. Silvanus Thompson in 1889 was able to use the electric arc, which was then just beginning to come to the front as a commercial illuminant. With this unrivalled source of light he was able to show for the first time in a public lecture a large number of the properties of polarised light which had been reserved hitherto for individual observation in the laboratory. The remarkable effects which are seen when light of one single colour or wave-length is substituted for white light were shown by Spottiswoode in 1878, with the help of a powerful sodium-lamp which had been devised by Sir James Dewar. His lecture was aptly described as "A Nocturne in Black and Yellow."

During several years I have taken a special interest in seeking to discover other sources of monochromatic light for use, in experiments on polarisation, and have been particularly concerned to proclaim the merits of the mercury arc as an illuminant for everyday use in optical investigations.

The Mercury Arc.

The spectrum of the light produced by passing an electric discharge through mercury vapour was described by Wheatstone in 1835 in a report to the British Association on the prismatic decomposition of electric light; but it was not until twenty-five years later that a real mercury-lamp was invented by Prof. Way. This consisted of an intermittent jet of mercury which was directed into a cup half an inch below. The current from a battery of Bunsen cells was passed through the jet and developed an intense light. The spectrum of the light was examined by Dr. J. H. Gladstone, and described in a paper on the electric

light of mercury, published in the *Philosophical Magazine* of 1860 (vol. xx., pp. 249–53).

The first use of the mercury arc as a source of light in polarimetry appears to have been made just ten years ago by two German workers, Disch and Schönrock, working independently (Disch, *Ann. Phys.*, 1903 (IV.), vol. xii., 1155; Schönrock, *Zeit. Vereins Deutsch. Zuck. Ind.*, Tech. Part, 1903, vol liii., 652). Through the personal kindness of Mr. Bastian, I was enabled about three years later to make use of the same source of light in what is still, perhaps, its most convenient form. The glass Bastian lamp was designed to burn with the coils of the arc in a horizontal plane, and was arranged to light automatically in this position. It was with great delight, therefore, that I discovered that, in spite of all warnings to the contrary, the lamp would continue to burn for any length of time with the coils raised into a vertical plane; in this position one of the straight portions of the arc could be focussed by a condenser directly on to the slit of a spectroscope, and so used to illuminate the field of a polarimeter. The lamp consumed very little current, and could be connected directly to the ordinary lighting circuits without any risk of "blowing" the fuses; it was cheap to purchase, and as the resistances formed part of the holder of the lamp there was no need for any auxiliary apparatus whatever. In view of its special suitability for polarimetric work, it is to me personally a matter of some regret that this pioneer lamp has been displaced completely by the more powerful arcs, encased in refractory silica glass, which now adorn the exteriors of so many places of amusement.

When using the mercury arc as a source of violet light, account must be taken of the greatly reduced sensitiveness of the eye to light of such short wavelength. It is here that the silica mercury lamp has proved of such great utility. I am indebted both to Mr. Lacell, of the Silica Syndicate, and to the Brush Electrical Engineering Company for allowing me, for experimental purposes, to distort their well-considered designs for commercial mercury arc lamps. Here, for instance, is a horizontal lamp which has been altered so that the arc can be seen at its greatest intensity in an end-on position. At first the light was liable to be obscured by globules of condensed mercury. But by recessing the window it was kept sufficiently hot to prevent condensation, and this difficulty was effectively overcome. Even then, however, the arc was not so convenient as one arranged in a vertical plane, like the upturned Bastian lamp. It was at this stage that I persuaded the Brush Company to modify for me their "Quartzlite" lamp by twisting one of the terminal **U**-tubes into such a position that it did not empty itself when the lamp was raised into a vertical plane. The "end-on" lamp and the vertical "Quartzlite" lamp have been described in the Transactions of the Faraday Society (1912, vol. vii., pp. 267–70), and were exhibited at the Optical Convention of June, 1912. The lamp shown in Fig. 1 has not been described previously. It combines the merits of both of the preceding patterns, and can be used either horizontally or vertically, and either in a side-on or in an end-on position.

The "Pinch Effect."

One feature of the silica mercury-lamps is sufficiently remarkable to deserve attention. When the arc is first struck by tilting the lamp it fills the whole of the bore of the half-inch tube which encloses it; but, in accordance with Faraday's observation that currents travelling in the same direction attract one another, the parallel threads of current are drawn together until finally, as you see, the arc is "pinched" together into a thread occupying only about one-third of the diameter of the tube. This pinching together of the arc contributes substantially to its efficiency as an illuminant in polarimetric and spectroscopic work; but it is not a suitable form for projection, which demands, as a condition for successful work, a powerful point-source of light.

If the current in the mercury arc is increased, the pinching effect may extend to the point of breaking the threads of current completely and so extinguish the arc.

It may be of interest to refer here to the well-known fact that the "pinch effect," which I have exhibited on a small scale in a mercury-lamp, is of great importance in the electrical melting of steel on a large commercial scale. In that case a current of great magnitude, flowing through a mass of molten steel enclosed in a circular channel, sometimes causes the metal to pinch together to such an extent that the circuit is actually broken. The "pinching" apart and running together of the mass of molten metal produce a somewhat thrilling display.

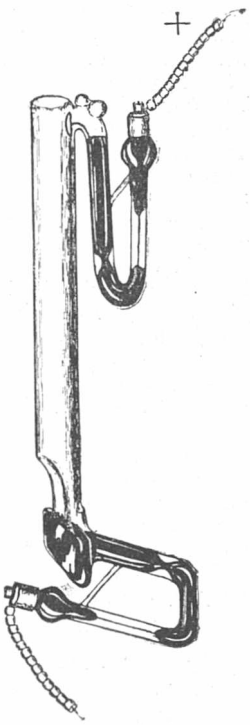


FIG. 1.—Mercury lamp for use in a horizontal or vertical, side-on or end-on position.

The Mercury Spectrum.

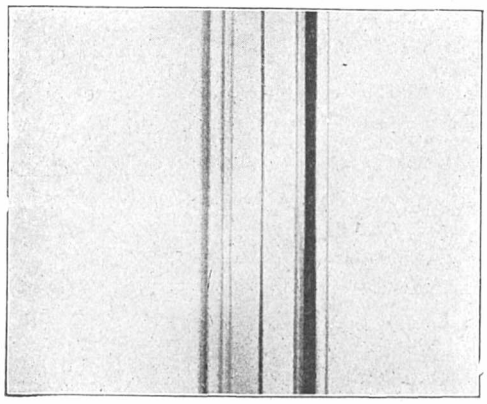
The mercury arc differs from the carbon arc in giving an extremely simple line-spectrum, the chief features of which are a yellow, a green, and a violet component. The yellow component contains two lines, separated by about twenty units of wave-length as compared with six units for the yellow sodium doublet; it shows up well in the spectrum, but on account of its duplex character it is not suitable for use in exact measurements.

By means of powerful high-resolution apparatus, such as the echelon spectroscope, the green line of the mercury spectrum has also been shown to be complex (Fig. 2); but in this case the components are so close together that they do not in any way reduce the value of the line as a source of monochromatic light. The extreme brilliancy of this green line, its high spectroscopic purity, and the ease with which it can be produced, have given to it an unrivalled position amongst the various sources of monochromatic light which are now available for polarimetric work. I can say with confidence that no one who has worked with the mercury-lamp will ever wish to return to the sodium flame, which it is rapidly displacing both in scientific and in technical laboratories.

Dr. Gladstone directed special attention to the strength of the violet lines in the spectrum, of one of which he said that "this ray is situated far beyond what is ordinarily considered the limit of the luminous spectrum." This deep-violet component contains two lines which are clearly visible in the spectroscope; but they lie so near to the limit of visibility that their presence can be shown most clearly with the help of a fluorescent screen. The bright violet line is, from the scientific point of view, one of the most valuable

features of the mercury spectrum. The main line is accompanied by two satellites of greater refrangibility; But these are so close to the principal line, and are of so much smaller intensity, that they do not diminish appreciably the unique value of this line, which still remains the most powerful source of monochromatic light for work at the violet end of the spectrum. Actual measurements in which the violet line has been used, both with and without the satellites, have shown that the errors introduced by the presence of the latter do not exceed one part in 10,000 on the readings of a polarimeter. This error would, therefore, be quite inappreciable in the case of all readings of less than 100°.

The visible spectrum does not by any means exhaust the usefulness of the mercury arc. The powerful series of ultra-violet lines, which are freely transmitted by the glass of the silica lamps



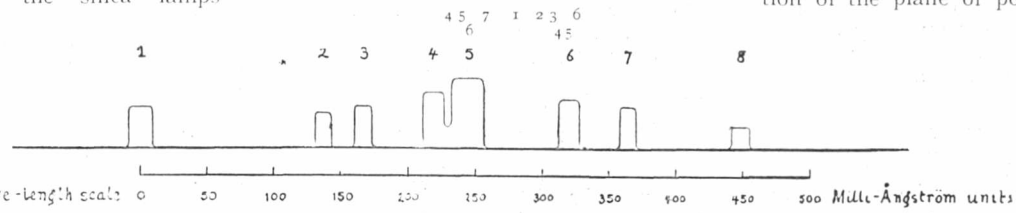


FIG. 2.—Resolution of the mercury-green line by the echelon spectroscope. The actual distribution of the components is shown by the diagram. (*By courtesy of Prof. Stansfield.*)

(Fig. 3), are of value for a number of scientific purposes, and have found an important technical application in the sterilisation of water.

At the other end of the spectrum, the magnificent though invisible line at wave-length 10,140 has proved to be of unique value as a starting point for calibration work in the infra-red. It will also be remembered that some of the longest waves of light that have yet been detected were discovered by Rubens in the radiation from a mercury lamp.

coloured screens prepared from gelatine films stained with suitable dyes.

B.—*Rotatory Polarisation.*

The phenomenon of rotatory polarisation was first discovered in the case of quartz. Arago in 1811 (Mem. Inst., 1811, pp. 93–134) found that a plate of quartz interposed between a polariser and analyser was capable of depolarising the light in such a way that transmission took place where previously there had been complete extinction. When plates of suitable thickness were used the transmitted light was no longer white, but beautifully tinted, the colour of the light varying with the thickness of the plate. Thus with increasing thickness we have progressively yellow, orange, rose-red, violet, blue, and green.

These colours were shown by Biot to be due to a rotation of the plane of polarisation, which increased (*a*) with thickness of the plate, (*b*) with change of colour from red to violet. It is therefore impossible when a beam of polarised light has passed through a quartz plate to extinguish all the colours simultaneously.

The tints which Arago observed were due to the selective extinction of light of different colours by the mirror which he used as an analyser. This selective extinction may be shown by inserting a direct vision spectroscope in front of the apparatus: the plate

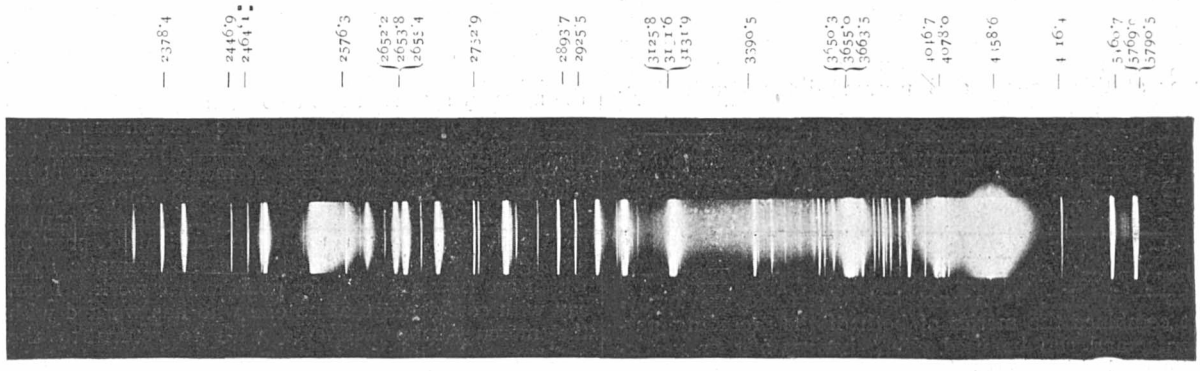


FIG. 3.—The ultra-violet spectrum of mercury. (*By courtesy of Messrs. A. Hilger, Ltd.*)

Resolution of the Mercury Spectrum.

One merit of the mercury arc as a source of light consists in the readiness with which the three main components may be separated. A direct vision prism of quite moderate dispersive power, placed in front of the eyepiece of a polarimeter, produces a separation of the three images which is sufficient for most purposes. The lines may also be separated by means of

which produces the pale yellow colour has rotated the violet light through 180°, so that it is extinguished exactly as if no quartz plate were present; the yellow tint is the complementary colour to that extinguished. As the thickness of the plate increases, the same effect is produced with light of longer wave-length; as the extinction moves from violet to red the complementary colour changes from yellow to orange, red, blue, and

green. When the bright yellowish-green is extinguished a grey "neutral tint" is produced which is extremely sensitive to small rotations of the plane of polarisation, and was at one time used very largely in polarimeters illuminated with white light.

When monochromatic light is used—as, for instance, when a green screen is placed in front of the mercury arc—the light can be extinguished completely even after it has passed through a very long column of quartz. Using green light purified by a spectroscope and rods of quartz cut from a crystal of extraordinary beauty, I have obtained a perfectly sharp extinction with a column of quartz half a metre in length, giving an actual rotation of $12{,}789{\cdot}20° \pm 0{\cdot}01°$. I have also been making experiments with the same material to determine accurately what rotation is produced by quartz in light of different wave-lengths, not only in the visible spectrum, but also in the infra-red and ultra-violet regions; but as the work is still incomplete, I will not attempt to describe it, but pass on at once to other ways in which rotatory polarisation may be produced.

Three years after his discovery of rotatory polarisation in quartz Biot was astonished to find that the same property was possessed by certain liquids, turpentine and laurel-oil rotating the plane of polarisation to the left, and oil of lemon and camphor (dissolved in alcohol) rotating it to the right.

In the case of quartz, Biot had attributed the rotation of the plane of polarisation to the crystalline structure of the material. The correctness of this view was proved when it was shown that rotatory polarisation no longer took place when the crystalline structure of quartz was destroyed by melting it or by dissolving it in alkali. In the case of liquids this explanation was no longer possible. Rotatory polarisation must here be attributed to some lack of symmetry in the structure of the molecule rather than of the crystal. It is in such cases that the polarimeter has proved its supreme value in the investigation of molecular structure. In this connection it will be sufficient if I refer to the classical researches of Pasteur, van't Hoff, and le Bel, and to the brilliant contemporary work of Pope, Kipling, Smiles, and Mills in our own country, and of Meisenheimer and Werner on the Continent. In each of these investigations the development of "optical activity" has been accepted as a conclusive proof of molecular asymmetry, and no firmer basis for theories of molecular structure has yet been found than that which rests upon the use of the polarimeter to detect rotatory polarisation.

C.—*Mutarotation.*

In 1846, thirty years after Biot had discovered that rotatory polarisation might occur in liquids as well as in crystals, a remarkable discovery was made by the French chemist Dubrunfaut in reference to the rotatory power of aqueous solutions of grape-sugar or glucose. Dubrunfaut found that by using freshly prepared solutions of the sugar he could observe a transient rotatory power which was twice as great as that observed in solutions which had been prepared a few hours previously. To this remarkable phenomenon he gave the name Birotation.

The same phenomenon, which is now generally known as mutarotation, has since been observed in the case of nearly all the "reducing" sugars. Many explanations were given to account for so mysterious a change, but nothing in the way of proof could, as a rule, be offered in support of these suggestions. In 1890, however, Emil Fischer discovered that similar changes of rotatory power occurred when gluconic lactone was dissolved in water and thus partially hydrolysed to gluconic acid—

$$\underset{\text{Gluconic lactone}}{C_6H_{10}O_6} + H_2O \rightleftharpoons \underset{\text{Gluconic acid.}}{C_6H_{12}O_7}.$$

He therefore suggested that a similar explanation might be given of the mutarotation of glucose, thus—

$$\underset{\text{Glucose.}}{C_6H_{12}O_6} + H_2O \rightleftharpoons \underset{\text{Glucose hydrate.}}{C_6H_{14}O_7}.$$

Mutarotation of Nitrocamphor.

In 1896 a happy accident led to the discovery that very marked changes of rotatory power occur in freshly prepared solutions of nitrocamphor. But, unlike the case of glucose, these changes could be observed in a large range of solvents. The change varied greatly in the numerical values involved, but was always in the same direction—from left towards right.

The cause of the mutarotation was not difficult to discover. It could not be due to hydration, nor indeed to any direct chemical action of the solvent, but must be attributed to some change of structure in the molecule of the nitrocamphor itself. In view of the fact that the nitro-compound is able to simulate the properties of an acid, giving rise to strongly dextrorotatory salts, there could be little doubt that the change of rotatory power was caused by a partial conversion of the nitrocamphor into its acidic form—a conversion which can be rendered complete by the addition of alkali. This view was immediately confirmed by the discovery of a dextrorotatory anhydride, which could be prepared from nitrocamphor merely by evaporating its solutions on a water-bath.

This interconversion of isomeric compounds, which we have called dynamic isomerism, could also be used to explain the mutarotation of glucose, of which two isomeric forms are known; but there is good reason to believe that the hydrolysis suggested by Fischer is also an important factor when aqueous solutions of the sugar are under consideration.

In the case of π-bromonitrocamphor two isomeric forms of the substance can actually be isolated, thus affording direct evidence that the mutarotation observed in the case of this compound is due to a reversible isomeric change.

Form of the Curves.

In most cases the change of rotatory power proceeds according to a very simple law, the rate of change being directly proportional to the distance still remaining to be traversed.

But I have recently found a number of cases in which the curves are far more complex. In such instances it is necessary to assume a series of successive isomeric changes; but this assumption presents no difficulty, as the substances in question can all be formulated in at least five different ways.

Acceleration by Catalysts.

The mutarotation of glucose is accelerated to a moderate extent by acids and very largely indeed by alkalis. Similar observations have been made in the case of nitrocamphor. Piperidine added to a solution of nitrocamphor in benzene produces a remarkable acceleration which can be detected even at a concentration of N/10,000,000, *i.e.* 1 part in 100 million or 1 centigram per ton. Aniline is 100,000 times less active.

Arrest of Isomeric Change.

The fortunate selection of chloroform as one of a series of solvents led to the discovery of one of the most important facts that have come to light in the course of fifteen years' work on mutarotation. In the very earliest stages of the work it was found that

solutions in chloroform behaved in a very irregular and surprising way; the mutarotation in this solvent seemed sometimes to "hang fire" until set going by some accidental stimulus. These observations were evidently important as proving that isomeric change was not spontaneous, even after the nitrocamphor had been dissolved. But for ten years no explanation was forthcoming to show why this phenomenon was observed in chloroform and in chloroform only. About five years ago, however, an arrest of isomeric change was again observed in the case of chloroform solutions to which a trace of acid had been added. These solutions (the rotatory power of one of which "held up" absolutely during twenty-four days) acquired a pungent and horrible odour, and had evidently undergone marked decomposition. It was not long before the odour was recognised as being due to carbonyl chloride—a well-known and (in anæsthetic chloroform) a dangerous impurity, formed by oxidation of the chloroform according to the equation—

$$CHCl_3 + O = COCl_2 + HCl.$$

This substance has the property of attacking ammonia and organic bases, such as piperidine, and converting them into neutral ureas, as shown by the equations:—

$$COCl_2 + 2NH_3 = CO(NH_2)_2 + 2HCl,$$
$$COCl_2 + 2NC_5H_{11} = CO(NC_5H_{10})_2 + 2HCl.$$

The next step was obviously to try to arrest the isomeric change by the addition of carbonyl chloride to a solvent which did not naturally contain it. This was done with marked success. A solution of nitrocamphor in purified ether showed a change of rotatory power extending over about a day; by the addition of carbonyl chloride the period was increased to eighteen days in a glass vessel, and to sixty-one days when a silica vessel (free from alkali) was used to contain the solution. In the case of benzene, to which acetyl chloride was added, the period was increased from sixteen days to sixty-four days in glass, and to two years in a silica vessel. Finally, by the addition of carbonyl chloride to a solution of nitrocamphor in benzene contained in a silica vessel the period was increased from sixteen days to six years.

Action of Light.

A convenient method of studying the effect of light on isomeric change has recently been devised in which the polarimeter plays a leading part. The solution to be studied was enclosed in a silica tube, surrounded by a silica water-jacket, and exposed to the light from a silica mercury-lamp. In seven cases out of nine, however, no acceleration whatever could be detected as a result of this extremely powerful "insolation."

I have attempted to give some account of a few instances in which polarised light has been applied to the solution of chemical and physical problems. In each case the observations have taken the form of measurements of rotatory polarisation. Measurements such as these have supplied to the chemist a key which has enabled him to unlock the strong-room in which many of the secrets of molecular structure were stored. The physicist, too, following in the footsteps of Faraday, has found in rotatory polarisation a link between the sciences of magnetism and optics, and has obtained valuable hints as to the way in which light is propagated through matter. The hundred years which have elapsed since Biot announced his great discovery have therefore served only to enhance its brilliancy, and to reveal it as one of the most illuminating disclosures even of the splendid period in which it was made.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—At Emmanuel College the following awards have been made for post-graduate research:—Studentships: W. N. Benson (petrology), 75*l.*, for half-year only; J. Macdonald (the development of Plato's ethics), 120*l.*; G. Matthai (continuation of research on the comparative anatomy of corals), 150*l.* Grants from the research studentship fund: R. T. Beatty (the energy of Röntgen rays), 25*l.*, for one term only; J. H. Burn (biochemistry), 50*l.*

LEEDS.—Mr. E. L. Hummel has been appointed professor of mining. Mr. Hummel is a son of the late Prof. Hummel, and was educated at Leeds and in Austria. He has had much practical experience in the Yorkshire coalfield and in South Africa with the Vereeiging Estates Company.

MR. WALTER R. CRAWFORD, of Tullyhogue, co. Tyrone, Ireland, has been appointed live stock officer for Yorkshire under the scheme for the improvement of live stock which has been inaugurated by the Board of Agriculture, with the aid of funds set aside by the Development Commissioners. Mr. Crawford has been a chief inspector under the live stock improvement scheme of the Department of Agriculture for Ireland, and is an authority on the breeding of shorthorns and on the work of milk record associations.

LONDON.—An important correspondence between the University authorities and Lord Haldane with reference to the new site for University headquarters has been published. Lord Haldane, in a letter dated June 6, states that he is willing to try again to interest the donors who were prepared in March to acquire the Bedford Estate (British Museum) site for the University. In reply, the Vice-Chancellor raised the questions of the provision of funds for rates and taxes, and for buildings, and of securing an option for additional land in the neighbourhood for extensions. He also inquired whether it would be possible to close the central road between the buildings to traffic. Lord Haldane, in a letter dated July 13, was able to give satisfactory assurances on these points. The sites committee of the University have decided to postpone further consideration until a conference is arranged with the London County Council.

At the meeting of the Senate on July 16, the D.Sc. degree was granted to Mr. J. C. Chapman (King's College) for a thesis on secondary Röntgen radiation; to Dr. G. C. McK. Mathison (University College) for a thesis on the action of asphyxia upon nerve centres; and to Mr. J. Johnstone for a thesis entitled "Tetrarhynchus Erinaceus, van Beneden—I., Structure of the Larva and Adult Worm."

Sir Harry Waechter has offered 300*l.* a year for five years for a department for the treatment of disease by vaccine therapy at University College Hospital.

Grants amounting to 375*l.* for 1913–14 have been made to the following out of the Dixon Fund, for the assistance of various researches:—The Brown Animal Sanatory Institution, Prof. G. Barger, Mr. Morley Dainow, Mr. P. E. Lander, Miss Constance Leetham, Dr. Martin Lowry, Dr. Geoffrey Martin, Mr. J. W. McLeod, and Mr. J. A. Pickard.

PROF. JOHN LAIRD, professor of logic in the Dalhousie University, Halifax, Nova Scotia, has been appointed to the chair of logic and metaphysics in the Queen's University, Belfast, in succession to the late Prof. Park.

AN anonymous donor has given 500*l.* to the South-Eastern Agricultural College, Wye, for the extension of the research department, and the Development Commission is recommending a grant of 6000*l.* for the completion of the new college buildings. The governors have decided upon the erection of the buildings at the Fruit Research Station at Malling, the land for which (twenty-two acres) has been purchased by the Kent County Council.

THE following benefactions, among others, we learn from *The Times*, have been left to the British Academy by the late Miss Henriette Hertz:—2000*l.* for an annual lecture, investigation, or paper on a philosophical problem, or some problem in the philosophy of Western or Eastern civilisation in ancient and modern times bearing on the phenomena of life in relation to eternity; 1000*l.* for an annual public lecture on some master mind, considered individually with reference to his life and work, specially in order to appraise the essential elements of his genius, the subjects to be chosen from the great philosophers, artists, poets, musicians; and 1000*l.*, the income of which is to be used to promote the publication of some philosophical work or to reward some meritorious publication in the department of philosophy. Miss Hertz also left the sum of 1500*l.* to Girton College, the income to be used for the endowment of archæological research.

THE Board of Agriculture and Fisheries has awarded research scholarships in agricultural science of the annual value of 150*l.*, tenable for three years, to the following candidates, viz.:—E. W. Barton (Wales), economics of agriculture; W. Brown (Edinburgh), plant pathology; Miss E. C. V. Cornish (Bristol), dairying; F. L. Engledow (London), genetics; E. J. Holmyard (Cambridge), plant nutrition and soil problems; R. C. Knight (London and Bristol), plant physiology; F. J. Meggitt (Birmingham), agricultural zoology; H. Raistrick (Leeds), animal nutrition; G. O. Sherrard (Dublin), genetics; T. Trought (Cambridge), genetics; G. Williams (Wales), animal nutrition; S. P. Wiltshire (Bristol), plant pathology. The Board has also awarded Miss T. Redman (London), a scholarship in dairying, tenable for two and a half years, to fill a vacancy caused by the resignation of a former scholar. The scholarships have been established in connection with the scheme for the promotion of scientific research in agriculture, for the purposes of which the Treasury has sanctioned a grant to the Board from the Development Fund; they are designed to provide for the training of promising students under suitable supervision with a view to enable them to contribute to the development of agricultural science.

THE May issue for this year of the *Johns Hopkins University Circular* takes the form of the University Register for 1912–13. The volume contains an interesting historical introduction, which points out that the Johns Hopkins University was founded by a merchant of Baltimore, Johns Hopkins, who bequeathed the greater part of his estate for the establishment of a university and a hospital. The University was incorporated on August 24, 1867. Instruction began in 1876, in which year President D. C. Gilman, from the University of California, was appointed first president, and remained in office for twenty-five years, being succeeded in 1901 by President Remsen, who resigned last year. The original endowment of the University amounted to somewhat more than 600,000*l.* This has been supplemented by several gifts, including the Endowment Fund of 1902 (200,000*l.*), the John W. McCoy Fund (100,000*l.*), and the Garrett Fund of 60,000*l.*, in addition to many other large sums. The income-bearing funds have a book value of more than 1,000,000*l.*, and the real estate and buildings, books, scientific apparatus, and general equipment are valued at more than 450,000*l.* The assets of the University have thus a total value of a million and a half sterling. By Act of the Legislature of Maryland, at its session of 1912, the sum of 120,000*l.* was granted for the purpose of constructing and equipping buildings for a school of technology as a department of the University, with an annual appropriation of 10,000*l.* for maintenance.

THE Government's education policy was outlined by Mr. J. A. Pease, President of the Board of Education, in introducing in the House of Commons on Tuesday a "Bill to amend the law in respect to grants in aid of building, enlarging, improving, or fitting up elementary schools." In the course of his remarks, Mr. Pease said that the defects of our so-called national system of education are two—it is not national and it is not a system. The age at which compulsory attendance at school ceases under the existing law is too early; and to allow children to leave school at the age of from twelve to fourteen years, and leave them to forget what they have learned, is to neglect national responsibility. One main purpose of the Government is to organise intermediate education—that is, all classes of education from the elementary school and the university—by extending the powers and duties and adding to the resources of local education authorities. Further duties of these authorities must be accompanied by further and substantial assistance from the State. Out of 29,834,000*l.* spent on education in 1911–12, 14,186,000*l.* was obtained from the rates and 13,648,000*l.* from Exchequer grants. The increase in expenditure since 1905–6 has been 3,500,000*l.* drawn from the rates and 1,000,000*l.* from grants, or out of every additional 1*l.* required in the last six years 7*l.* had been found by the ratepayers and 2*l.* by the taxpayer. The demand which the ratepayer has for further relief for the taxpayer must, therefore, be admitted. As regards higher education, there will be no interference with the independence of the universities or with the government of training and technical colleges. The principles of the proposed legislation will be the arbitrary provision of intermediate education for all who desire it, placing it within the reach of all classes, and the coordination of such provision between authorities to prevent overlapping. Local authorities will have the duty imposed upon them of affording children during the latter years of elementary-school life opportunities of obtaining such instruction of a more advanced character than that given in the ordinary public elementary schools as may be thought suitable to the circumstances of the children. For this purpose the limit imposed by the Act of 1902 on the amount that might be raised by way of rates for the purposes of higher education will be removed. To give effect to the proposals of the Government, will require a large and substantial addition to the sum at its disposal, which will rise progressively from the first, second, third, and subsequent years. The forecast, of which no details can yet be given, includes provision for the universities, provision for the reconstitution of London University, and provision for the maintenance of increased secondary and technical schools.

SOCIETIES AND ACADEMIES.

DUBLIN.

Royal Irish Academy, June 23.—Dr. F. A. Tarleton in the chair.—H. **Ryan** and Rev. J. M. **Dunlea**: Unsaturated diketones. I. By the condensation of

cinnamic ester with acetone, acetophenone, methyl-ethyl-ketone, and isopropyl-methyl-ketone, the unsaturated β-diketones, cinnamoyl-acetyl-methane, cinnamoyl-benzoyl-methane, cinnamoyl-propionyl-methane, and cinnamoyl-*iso*butyryl-methane were synthesised, and their structural properties examined.—H. **Ryan** and J. **Algar**: Unsaturated diketones. II. Although benzylidene-acetone does not condense to a β-diketone with benzoic ester in the presence of sodium it reacts readily with dimethyl oxalate. Similarly anisylidene-acetone condenses to a β-diketone with dimethyl oxalate. The diketones formed isoxazols with hydroxylamine hydrochloride, and behaved as weak mordant dyes.—G. H. **Carpenter**: Aptera, in connection with the Clare Island Survey. Eighteen species of Collembola and two of Thysanura are recorded from Clare Island, and the apterygotan fauna is found to present, on the whole, an Arctic and American facies. One of the commonest insects on the island and neighbouring mainland is *Petrobius maritimus*, Leach. Some details of the external anatomy of this species are given, and it is shown that the Dutch shore-haunting bristle-tail described by Oudemans, and called *Machilis maritima*, is entirely distinct from the British and Irish insect named by Leach.—W. M. **Tattersall**: Amphipoda, in connection with the Clare Island Survey. The number of species recorded in this paper from the Clare Island marine area is ninety-five. No new species are described, but nineteen species are added to the Irish list for the first time, and fifty-four species are new to the area under review. The Amphipoda of Clare Island include thirty-three Arctic species and sixty-two non-Arctic. Of the former, fourteen extend to the Mediterranean and twelve to the coasts of America. Of the non-Arctic forms, twenty-five are found in the Mediterranean, a further twenty-one are confined to the Atlantic coasts of Europe from Norway to France. Six species are common to the British area and the Mediterranean, but do not extend to Norway. A further ten species are confined to the waters of the British area and neighbourhood, and are unknown from both Norway and the Mediterranean.—R. **Southern**: Nemertinea, in connection with the Clare Island Survey. The total number of species found in the Clare Island area was thirty-one. Of these, two species, *Lineus acutifrons* and *Prostoma beaumonti*, were described as new. *Tubulanus banyulensis*, Joubin, was added to the British fauna, and seven other species were obtained which had not previously been recorded from Ireland. The Nemertean fauna as a whole closely resembles that found in the south-west of England.

Royal Dublin Society, June 24.—Prof. H. H. Dixon, F.R.S., in the chair.—Miss M. C. **Knowles**: Maritime and marine lichens of Howth (Dublin Bay). Altogether 180 species are recorded from the Howth coasts in this paper, of which three are now described for the first time, and twenty-three are new to Ireland. An attempt has been made to give an account of the lichen vegetation from an ecological as well as from a systematic point of view, and the various species are described as growing in the following succession of belts from the top of the cliffs to low-water mark:—(1) The Ramalina belt; (2) the belt of orange lichens; (3) the Lichina vegetation; (4) the *Verrucaria maura* belt; (5) the belt of marine Verrucarias. The composition of each belt is given in detail.—Prof. G. H. **Carpenter**: Injurious insects and other animals observed in Ireland during the year 1912. The very hot, dry summer of 1911 led to an excessive abundance of insects in the spring of 1912, from the depredations of which orchards and fruit-trees suffered heavily. "Greenfly" on apple-trees were especially abundant, and two distinct kinds of Aphis occurred in many parts of Ireland. Referring to the "woolly aphid," or "American blight," attention was directed to a new mode of wintering for the insects—inside the cores of apples, several of which, imported from America and sold in Dublin, were found to be infected in this way. Introduction of the pest into fresh localities might thus be brought about.—W. R. G. **Atkins**: Oxydases and their inhibitors in plant tissues. The distribution of oxydases seems to point to their being concerned in the production of cork and sclerenchyma. The guard cells of stomata and the cells abutting on them are particularly rich in "epidermal" oxydase, while the abutting cells may also contain the bundle oxydase of Keeble and Armstrong. The leaf-saps of *Iris germanica* and *Aspidium Filix-mas* contain powerful reducing substances which inhibit oxydase reactions. Precipitation of the enzymes by alcohol or removal of the reducing substance by dialysis permits of the detection of oxydase. The colours of the perianth of Iris are due to the presence of a yellow plastid pigment or of a purple anthocyan chromogen which arises by the action of the epidermal peroxydase on a chromogen. The reducing substance may inhibit colour production.—Dr. W. E. **Adeney**: The "streaming" of dissolved atmospheric gases in water. Part i. In this communcation there are given the results of an experimental investigation of the rates at which atmospheric nitrogen and oxygen are dissolved by the exposed surfaces of quiescent columns of de-aërated fresh- and sea-water, and the rates at which the dissolved gases are transmitted downwards through the columns under the conditions: (1) when evaporation can freely take place from the exposed surfaces of the columns, and (2) when it cannot, the columns of water being maintained at a uniform temperature. The determinations have been made for temperatures varying between 8° and 20° C. Descriptions of special apparatus for the rapid extraction of the dissolved gases from water, and for their analysis, are also given.

EDINBURGH.

Royal Society, June 2.—Sir William Turner, K.C.B., president, in the chair.—Sir William **Turner**: Contributions to the craniology of the people of the Empire of India. Part iv. The author described and compared a number of skulls from the Bhils, frontier tribes of Burma and Pakkoku, South Shan tribes, and Tibetans.—Dr. J. H. Harvey **Pirie**: Scottish National Antarctic Expedition, glaciation of the South Orkneys. This was a full account of a careful survey made by Dr. Pirie when wintering at the South Orkneys. These glaciers are either of the "ice-foot" or of the "Spitsbergen" type, according to Nordenskjöld's classification. Their movement and erosive powers are very slight, and they are at present much less extensive than at former times.

June 16.—Dr. B. N. Peach, vice-president, in the chair.—Dr. J. G. **Gray**: New models of gyrostats. When large rotational speeds are employed, the fly-wheels must be perfectly balanced. Some of those exhibited could be run up to 30,000 revolutions per minute. The largest size, when spun at 15,000 revolutions per minute, continued to revolve for forty-five minutes. Among the many curious devices shown was the model of a motor-car running on two wheels placed in tandem. The car was stable, both when at rest or when in motion. When in motion the car derived its stability from the propelling system. The gyrostat detected any tendency to tilt over and immediately applied to, and obtained from, the propelling system just the forces required to correct the tendency. This force disappeared precisely when its existence

was no longer needed, so that the contrivance was entirely free from gyrostatic oscillations. The model was shown moving slowly about the room under the direction of an electromagnetic driver seated on the car and controlled by a switch on the lecture table. The driver could also be operated by wireless transmission.

July 7.—Dr. J. Horne, vice-president, in the chair.—S. D. **Carothers**: Plane strain in a wedge with application to masonry dams. The equations of equilibrium for plane strain were applied to a sector of an infinite right cylinder bounded by two planes through the axis, when the plane faces were subject to various conditions of pressure, which was either constant or varying as the distance from the axis. The several appropriate solutions were combined with the solution appropriate to the case in which the body forces were considered so as to obtain a solution applicable to the case of a masonry dam. The displacements were worked out for one case.—Prof. J. Stanley **Gardiner**: The corals of the Scottish National Antarctic Expedition. Five species were described, of which one, referred to genus Madracis, was new. It was dredged off the Abrolhos Bank.—Dr. W. M. **Tattersall**: The Schizopoda, Stomatopoda, and non-Antarctic Isopoda of the Scottish National Antarctic Expedition. Of Schizopoda twenty-four species were recorded, including one new species of Boreomysis. The Stomatopoda were represented by one species of Squilla and three larval forms of Lysiosquilla; and of the eighteen species of Isopoda recorded, three were new, two of Exosphæroma, and one of Antarcturus.—Dr. J. H. **Ashworth**: Some pseudo-hermaphrodite examples of *Daphnia pulex*. The specimens were undoubted females, but in each the antennule of one side resembled that of a male, and in one case also one of the valves of the carapace had a configuration similar to that of a male. In all other features, both external and internal, the specimens exhibited female characters. The offspring of two of the specimens were available for examination, and proved to be entirely normal—that is, the structural peculiarities of the antennule were not transmitted.

PARIS.

Academy of Sciences, July 15.—M. F. Guyon in the chair.—J. **Boussinesq**: The theory of Savart's retractile liquid sheets.—Armand **Gautier** and P. **Clausmann**: Fluorine in the animal organism, brain, glands, muscles, blood, milk, excretions. Fluorine exists in all animal organs and tissues, but in very varying proportions. Excluding organs not completely formed in very young animals, and the excretions, there is a relation between the amounts of fluorine and phosphorus present; the two increase together without being proportional. The dental enamel has the highest proportion of fluorine, 180 to 118 milligrams in 100 grams of dry material; muscle has the smallest amount, 0·6 to 0·15 milligram in 100 grams of dry material. In man about 1 milligram of fluorine is excreted per day, and as the fluorine taken with the food is considerably greater than this figure, the difference represents epithelial desquamation, hair and nails, &c.—H. **Block**: The energy of nebulæ and Carnot's principle. A discussion of the theory of Arrhenius and an extension of some recent calculations on this subject by Schwarzschild.—Kr. **Birkeland**: The general magnetism of the sun.—M. **Robinson**: Systems of partial differential equations.—Th. **Anghelutza**: A generalisation of Riemann's summation.—M. **Ariès**: Remarks on a form of the velocity of propagation of sound in a homogeneous fluid.—Thadée **Peczalski**: New forms of the characteristic equations of gases.—Marcel **Boll**: The influence of the wave-length on the velocity of a photochemical reaction. A formula is given, based on experimental results, expressing the velocity of a reaction as a function of the thickness of the layer, concentration, coefficient of absorption, power and frequency of the incident radiation. The wave frequency acts in a manner analogous with temperature in ordinary chemical reactions.—M. **Blanchetière**: Oxidation and luminescence. A large number of substances have been examined for the production of luminescence on oxidation. The phenomenon was marked with lophine, amarine, hydrobenzamide, extracts of meat, urine, tea. The question as to the exact nature of the organic complex the oxidation of which results in luminescence was not solved.—S. **Wologdine**: The heats of formation of some silicates of iron and manganese.—Paul **Braesco**: The baking of clays.—Victor **Henri** and René **Wurmser**: The action of ultra-violet rays on solutions of hydrogen peroxide. The velocity of decomposition of hydrogen peroxide in monochromatic light is proportional to the concentration, to the incident energy, and to the energy absorbed. Einstein's law of photochemical equivalence does not apply to this reaction. The energy which is absorbed by the decomposition of a gram-molecule of hydrogen peroxide is sensibly equal to the energy evolved by the decomposition of the same quantity in the dark.—Daniel **Berthelot** and Henry **Gaudechon**: Addition reactions between carbon monoxide and other gases under the influence of the ultra-violet rays. Carbon monoxide, under the action of ultra-violet light, combines with chlorine, oxygen, water, ammonia, but not with bromine, iodine, sulphur, sulphuretted hydrogen, phosphine, arsine.—Léo **Vignon**: The formation of methane by catalysis, starting with carbon monoxide and water vapour. Details of experiments with iron, nickel, copper, and their oxides, silica, alumina, and magnesia, as catalysers at temperatures ranging from 300° C. to 1250° C.—H. **Gault**: The lactonisation of the α-ketonic esters.—Paul **Lebeau** and Marius **Picon**: The action of sodammonium on the true acetylenic hydrocarbons of the fatty series, and on a mode of formation of ethylenic hydrocarbons. Sodammonium reacts with the acetylenic hydrocarbons of the fatty series, giving the sodium derivative of these hydrocarbons and the corresponding ethylenic hydrocarbon in the proportion of one molecule of the ethylene to two molecules of the sodium derivative. The products of the reaction are very pure, and no secondary reactions were observed.—L. **Bounoure**: The influence of the size of insects on the production of chitin. The mean thickness of the chitin layer is constant, or the quantity of chitin is proportional to the secreting surface.—Edouard **Chatton**: *Orchitosoma parasiticum*, a parasite with three rudimentary leaflets of *Paracalanus parvus*.—E. **Faure-Fremiet**: The action of the ultra-violet rays on the egg of *Ascaris magnalocephala*.—Charles **Nicolle**, A. **Conor**, and E. **Conseil**: Intravenous inoculation of some living typhoid bacilli.—Gabriel **Bertrand** and Robert **Sazerac**: The favourable action exercised by manganese on the acetic fermentation. The power of the organism of transforming alcohol into acetic acid is strongly accelerated by the addition of a certain proportion of manganese; the acceleration increases at first as the amount of manganese increases, then passes a maximum.—R. **Fosse**: The presence of urea in the invertebrates and in their excretion products.—Jules **Ventre**: The influence of the yeasts and the initial constitution of the musts on the acidity of fermented liquids.—André **Mayer** and Georges **Schaeffer**: Researches on the lipocytic constancy. The proportion of lipoids containing phosphorus in the tissues.—M. **Repelin**: The geology of Sainte-Baume.

CALCUTTA.

Asiatic Society of Bengal, July 2.—F. F. **Laidlaw**: Note on the dragonflies of Syria and the Jordan Valley. The dragonflies of Syria and the Jordan Valley are still imperfectly known, but at least two geographical elements may be distinguished among them—a Mediterranean element, and a tropical one, African in its main features, but also showing certain affinities with the Oriental fauna.—Dr. N. **Annandale** and S. W. **Kemp**: The Crustacea Decapoda of the Lake of Tiberias. Three species of Decapoda are known from the Lake of Tiberias and its immediate vicinity, viz. the crab *Potamon potamios*, and the prawns *Atyaëphyra desmarestii* and *Typhlocaris galilea*. The last occurs only in one small isolated pool, and is remarkable on account of its degenerate eyes and uniform white coloration, as well as for certain structural characters which separate it from all other Caridea.

BOOKS RECEIVED.

Bacon's New Contour Map of the Near and Middle East (The Land of the Five Seas). (London: G. W. Bacon and Co., Ltd.) 7*s*. 6*d*.

Der Stoffwechsel der Pflanzen. By O. Stocker. Pp. iii+60. (Leipzig and Berlin: B. G. Teubner.) 2 marks.

Expedition Antarctic Belge. Resultats du Voyage s.y. *Belgica* en 1897-8-9. Rapports Scientifiques. Zoologie. Tuniciers, Caducichordata (ascidiaces et Thaliaces). By E. van Beneden and M. de Selys-Longchamps. Pp. 119+xvii plates. Geologie. Petrographische Untersuchungen der Gesteinsproben. By D. Sistek. II. Teil. Pp. 20+plate. (Anvers: J. E. Buschmann.)

The Journal of the Institute of Metals. Vol. ix. Pp. ix+333. (London: Institute of Metals, Caxton House.) 21*s*. net.

The Journal of the Municipal School of Technology, Manchester. Vol. vi. Pp. 277. (Manchester: Municipal School of Technology.)

The Princeton Colloquium. Lectures on Mathematics delivered September 15 to 17, 1909 before Members of the American Mathematical Society, in connection with the Summer Meeting held at Princeton University, Princeton, N.J. By G. A. Bliss and E. Kasner. Pp. v+107+ii+117. (New York: American Mathematical Society.)

Library Cataloguing. By J. H. Quinn. Pp. viii+256. (London: Truslove and Hanson, Ltd.)

The Under Dog. Edited by S. Trist. Pp. xv+203+v. (London: *The Animals' Guardian*.) 3*s*. 6*d*.

The Proceedings of the Optical Convention, 1912 held at South Kensington, June 19 to 26, 1912. Vol. ii. Pp. vii+359. (London: University of London Press; Hodder and Stoughton.) 10*s*. net.

Ce que j'ai vu chez les Bêtes. By P. Noël. Pp. 343. (Paris: A. Colin.) 3.50 francs.

An Introduction to the Mathematical Theory of Attraction. By Dr. F. A. Tarleton. Vol. ii. Pp. xi+207. (London: Longmans and Co.) 6*s*.

Industrial Poisoning from Fumes, Gases, and Poisons of Manufacturing Processes. By Dr. J. Rambousek. Translated and edited by Dr. T. M. Legge. Pp. xiv+360. (London: E. Arnold.) 12*s*. 6*d*. net.

The Mineral Kingdom. By Dr. R. Brauns. Translated, with additions, by L. J. Spencer. Parts 23, 24, 25. (Esslingen a.N.: J. F. Schreiber; London: Williams and Norgate.) 2*s*. net per part.

An Account of the Crustacea of Norway. By G. O. Sars. Vol. vi., Copepoda, Cyclopoida. Parts i. and ii. Pp. 32+xvi plates. (Bergen: Bergen Museum.)

A Manual of School Hygiene. By Prof. E. W. Hope, E. A. Browne, and Prof. C. S. Sherrington. New edition. Pp. xii+311. (Cambridge University Press.) 4*s*. 6*d*.

Evolution by Co-operation. By H. Reinheimer. Pp. xiii+200 (London: Kegan Paul and Co., Ltd.) 3*s*. 6*d*. net.

Hull Museum Publications. No. 94. A List of the Seventeenth-Century Tokens of Yorkshire. By T. Sheppard. Pp. 27-59. (Hull: The Museum.) 1*d*.

Plant Life. By Prof. J. B. Farmer. Pp. viii+255. (London: Williams and Norgate.) 1*s*. net.

Toadstools and Mushrooms of the Countryside. By E. Step. Pp. xvi+143+plates. (London: Hutchinson and Co.) 5*s*. net.

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