THURSDAY, JULY 4, 1907.

THE CONSTRUCTION OF DYNAMOS.

The Construction of Dynamos (Alternating and Direct Current). By Tyson Sewell. Pp. xi+316. (London: Crosby Lockwood and Son, 1907.) Price 7*s.* 6*d.* net.

SO many books have already been written on the subject of the dynamo that any new publication can only be justified on one of two grounds. Either it must contain new matter of practical importance not hitherto treated in such a way as to be useful to the designer, or it must be in comparison with existing books an improvement in the way of treating old and well-known matter, so that the student and the practical engineer may have less difficulty in grasping the subject than they often have with the existing books.

A perusal of Mr. Sewell's book will leave the reader with the impression that the designer of dynamos will learn nothing from it, and that the student may with equal advantage read any of the previous publications treating of the dynamo in a popular style. The book is in this respect no better and no worse than dozens of others. As regards its use for the design of dynamos, the author himself deprecates it, for he says in the preface:—

"The examples of design are introduced by way of illustration only. The actual designing of dynamos is the work of comparatively few men, most manufacturers having standardised particular lines which, with slight modifications, meet most requirements; and in view of the labours of the Engineering Standards Committee, further developments in the direction of uniform practice may be expected."

The idea underlying this sentence seems to be that as only few men have to design dynamos, and as the Engineering Standards Committee looks after these things, it is not necessary to treat of design in books. Yet in the first sentence of the preface the author says that his work is an attempt to treat of theory, design, and construction, and several chapters are devoted to working out the details of design.

The general arrangement of the book follows well-known lines. We get first the fundamental principles of direct currents, Ohm's law, its application to the "Silvertown Set" and Evershed's "Megger," though without description of the internal arrangement and only an outside view of the box. Then come a few pages on the magnetic field and on testing iron, but the treatment is incomplete, and in one case also misleading. This is the description of the magnetometric method, where the author fails to point out that it is only applicable to thin and long wires, and not to a turned iron rod, as he says; and that the effect of the solenoid must be eliminated by a special coil. In the next chapter we get all the well-known illustration (but on a prodigiously large scale) to show lines of force, and how by cutting them an E.M.F. is produced, and the formula for the E.M.F. of a two-pole dynamo. It would have been well if the author had also given the formula for a multipole machine in this place. The chapter following deals with the fundamental principles of the alternating current, and then we get to the alternating field. Here the author introduces the hysteresis loop, and mentions that its area is a measure of the work lost per cycle, but gives no proof. The figures he gives for the hysteresis coefficient of 0·002 to 0·008 are certainly much too large, and he is also in error when he says that in dynamo work the loss due to eddy currents is very small. It is well known that the losses in iron actually occurring in the dynamo are considerably in excess of the theoretically calculated losses, and that the increase is in a large measure due to eddy currents at the burred edges of the plates. When dealing with capacity the author gives a neat hydraulic analogy to show why the charging current is a quarter phase in advance of the E.M.F.

In the chapters on construction and theory of bipolar dynamos we find the usual illustrations, but all on a large scale, so that a good deal of space is uselessly occupied and the text correspondingly restricted. Although in the illustrations the author follows well-known lines, this cannot be said as regards his way of designing. Here we find some novelty, but hardly improvement on the usual practice. Thus, in giving the design of a 400 kw. 550 v. machine, he starts with the rule that 100 kw. is a fair average allowance per pair of poles, and finds thus that eight poles is the right type. Then he calculates the number of commutator bars on the basis of 5 v. per bar, and by assuming a certain thickness he arrives at the diameter, and again by assuming a certain circumferential speed he obtains the number of revolutions per minute. This freedom in the selection of speed may be convenient, but it is certainly not the condition which prevails in practice. As a rule the speed is given, and one has to design the dynamo to suit it. Having thus found the speed, the author proceeds to find length and diameter of armature by simply applying the so-called "output formula," but as he does it without critical investigation he gets rather unusual dimensions, namely, 93 inches diameter by 15½ inches long, whereas a little common-sense reasoning untrammelled by adherence to formula would have shown him that 80 inches by 20 inches would make a far better and cheaper machine. The number of conductors is found from a formula of circumferential current density, and so the designing goes on simply by applying formulæ without criticism, not a method to be recommended either to students or to "engineers who have occasion to deal with technical matters," as the author says in the preface.

Another claim made in the preface is only partially justified. The author says that "the available space is almost exclusively devoted to machines representing present standard practice." There are a few illustrations of the fly-wheel type of alternator, and also a turbo-alternator, and in so far standard practice is considered, but the "mono-coil-claw" type, Fig. 200, the inductor machine, Fig. 201, and the ironless machines of Mordey, Ferranti, and Crompton, are certainly not present standard practice, whilst the details of armature housing shown in Figs. 192 to 197 may

be modern, but are certainly not good practice. The author's explanation why field magnets are laminated is novel, and, moreover, so peculiar that it merits verbal quotation. He says :—

"The field cores are often laminated throughout to prevent eddy currents due to any swinging of the field caused by armature reaction, and this often leads to special methods of support."

Had he said that magnets must be laminated if the stator slots are wide and open, he would have been right, but the explanation he gives is quite beside the mark. Equally misleading is his indiscriminate recommendation of damping coils as a cure for hunting. As he mentions these coils just after saying that hunting is especially the fault of gas-engine driven machines, the reader is led to conclude that the damping coils would be especially useful in such cases, whereas every expert knows that damping coils are absolutely harmful if applied to an alternator driven by a gas engine. GISBERT KAPP.

STOKES'S SCIENTIFIC CAREER AND INFLUENCE.

Memoir and Scientific Correspondence of the late Sir George Gabriel Stokes, Bart., Past Pres.R.S. Selected and arranged by Prof. Joseph Larmor, Sec.R.S. Vol. i., pp. iv+475; vol. ii., pp. vi+507. (Cambridge: The University Press, 1907.) Price 24*s.* net, two volumes.

IT is well known that the record of Stokes's work, splendid as it is, which is contained in the five volumes of his collected papers is far from being a complete representation of the services which during a long life he rendered to science. From his first official connection with the Royal Society in 1854 the tide of production began somewhat to slacken, and after 1868, it may almost be said, no sustained piece of work of first-rate magnitude appeared under his name, although shorter papers, often of great value, and all showing the impress of the master-hand, were given out from time to time. His energies did not relax, and his powers never showed any sign of decay, but they were diverted into somewhat different channels. Partly owing to the rigorous sense in which he construed the duties of his various official positions, and partly in consequence of his own inexhaustible good nature, he was constantly occupied in examining, advising upon, and assisting in the work of others.

This gradual change in the manner of his work has been often wondered at, and sometimes deplored, but it came about quite consistently. There is a certain type of professional *savant* to whom systematic production, or at all events publication, with due form and circumstance, is as the breath of his nostrils; it must be maintained at all hazards. With this type Stokes had never any affinity. He took to mathematical physics, in the first instance, because his interests and his powers lay that way, and he published the results of his investigations, when they seemed valuable enough, as a matter of course; but when other duties came which had, as he thought, a more immediate claim, he turned to them without a moment's regret at the diminished opportunities of personal achievement which they involved.

For a complete memorial it was therefore essential that some presentation should be made of this important phase of his work. As Prof. Larmor explains, in the preface to the two volumes now before us, the material in the shape of letters is abundant; but it is naturally very varied in character, and often fragmentary, and much of it was from one cause or another difficult to turn to account. The labour of sifting and arranging the correspondence must have been enormous, and appears to have been aggravated by the circumstance of fresh letters continually coming to hand during the printing.

The material finally selected has been dealt with as follows. In "Section II." we have an outline of Stokes's general scientific career, illustrated by a chronological series of letters, which touch upon the various topics which at different stages attracted his attention. "Section III. A" contains "special scientific correspondence" with his father-in-law, Dr. R. Robinson, Prof. Cayley, and Sir J. Norman Lockyer. These letters contain matter which is, in different ways, of great interest; the letters to Dr. Robinson are specially valuable, as they preserve many interesting notes and explanations which would otherwise have been lost. The second volume continues "Section III.," and includes letters to and from Maxwell, Joule, Rayleigh, Reynolds, Froude, Airy, and others, nearly all bearing on scientific work of the first order actually in progress. It would be hopeless, and useless, to attempt an enumeration of the various points touched upon; but it is of interest to note with what zest Stokes turns, again and again, to the early objects of his scientific affections, such as the behaviour of sea-waves, the theory of the pendulum, and the varied problems of physical optics. The collection is most of all valuable in that we are allowed a glimpse into the workshop of the master. The most expert craftsman will find much to admire, whilst the novice may derive suggestion and encouragement, more perhaps than from the contemplation of the finished work, which is often apt to beget rather feelings of despair.

These volumes include also matter of a more formal biographical character. The introductory memoir by Mrs. Lawrence Humphry is a most attractive personal record, written with admirable tact and sincerity. To this are appended "appreciations" by intimate personal friends, Prof. Liveing, Sir Michael Foster, Sir William Huggins, and the Bishop of Bristol. Considerable space is devoted to the Jubilee celebration of 1899, and to the proceedings at the unveiling of the Westminster Abbey memorial. Both these occasions greatly impressed those who had the privilege of attending them, and the record will be highly valued.

All who are interested in Stokes and his work, in other words, the whole company of followers of physical science, will feel a deep debt of gratitude to Prof. Larmor for the devoted labour which he has expended on this memorial of his great predecessor. It appears, indeed, that our obligations to him are not yet exhausted. The reader of this notice will have remarked

the absence of all reference to the relations between Stokes and Lord Kelvin. We are told that this long scientific friendship is to be commemorated by a special volume of correspondence. There can be no question as to the propriety of this arrangement, and the volume will be looked for with the liveliest interest.

HORACE LAMB.

FIVE SMALL GEOGRAPHIES.

Our Own Islands. By H. J. Mackinder. Pp. xv+298. (London: George Philip and Son, Ltd., n.d.) Price 2*s.* 6*d.*

The Oxford Geographies. Vol. I. The Preliminary Geography. By A. J. Herbertson. Pp. viii+149. (Oxford: Clarendon Press, 1906.) Price 1*s.* 6*d.*

The Oxford Geographies. Vol. III. The Senior Geography. By A. J. Herbertson and F. D. Herbertson. Pp. viii+363. (Oxford: Clarendon Press, 1907.) Price 2*s.* 6*d.*

The Dominion of Man. By Ernest Protheroe. Pp. xii+215. (London: Methuen and Co., n.d.) Price 2*s.*

Notes upon the Island of Dominica (British West Indies). By Symington Grieve. Pp. 126. (London: A. and C. Black, 1906.) Price 2*s.* 6*d.* net.

ALTHOUGH no close comparison can be made between the two elementary reading-books in geography which Mr. Mackinder and Dr. Herbertson have given us, since the former deals with the British Isles and the latter with the whole world, yet we may note certain similarities of method. Both build up their descriptions about an imaginary journey from place to place; both endeavour to present physical and industrial geography as cause and effect; both largely use diagram-maps, partly to supplement the atlas, partly to stimulate the use of it; and both adopt, to some extent, the method of "teaching by question." While this last innovation is a step in the right direction, it is but a hesitating step. The full advantage of this method cannot be obtained by occasional interpolations of questions or suggestions for map-study amid the descriptive matter. Such interruptions are apt to be shelved until a more convenient season that may never come.

Mr. Mackinder's book is arranged on a progressive plan. While map scales and directions are taken at the outset, contour-lines are not explained until halfway through the book. Description starts with the north of England, the uplands and lowlands of which present an easy contrast. Scotland follows, then Ireland, Wales, and finally the Midlands and south and east of England. Simply and lucidly written, with many views and maps, it is a most readable book. We must, however, object to county-towns being called "capitals" (p. 143), to the coupling of Shropshire (strictly Shrewsburyshire) with Berkshire as a county name not derived from a town (p. 263), and to the printing of Macaulay's magnificent Armada lines cut in halves (p. 275).

Dr. Herbertson is unconventional in the order in which he takes the continents, starting with the Americas, because their physical and climatic conditions lend themselves best to simple generalisations, and they thus serve as a type with which Asia, Australia, Africa, and Europe are in turn contrasted. The immensity of the subject-matter renders occasional "scrappiness" of treatment inevitable, though in general this has been very successfully avoided, and attention concentrated on broad general features and contrasts. Altogether, it is a refreshing change from the old-fashioned dry text-books, but it needs supplementing with views to enable the child to realise the scenes described.

Both books have suffered a little from the troubles incidental to process-illustrations. The hemispheres on p. 3 of the "Preliminary Geography" are not all printed the right way up (this should have been avoided by processing them in pairs, instead of singly); and a phantom coalfield appears in Cheshire in Fig. 37 of "Our Own Islands."

By dividing the world into natural regions and showing how political divisions are related to these, Dr. and Mrs. Herbertson have produced an altogether admirable book. Particularly to be noticed is the treatment of the Alps as a whole, and the historical development of the Central European States in relation to them. There are only two small matters on which it occurs to us that the student needs further enlightenment—viz., the use of *Mont* for the names of passes as well as of peaks in the Western Alps (it is a common mistake to cite Mt. Cenis as a peak), and the misleading name of the first Alpine railway tunnel, taken from the Mt. Cenis carriage-route which it superseded. The historical summaries given for each country are very well done. We have noticed very few mistakes. *West* Indies, on p. 105, should surely be *East*; William the Conqueror did not march down stream from Wallingford (p. 142); and the statement on p. 68 as to the origin of Boulder-clay is rather dogmatic for so disputed a subject. It is difficult to be consistent in the spelling of European place-names, but to us at least *Luzern* looks as out-of-place in an English sentence as would Torino or Firenze. These are trivial criticisms on a book the reading of which has given us a great amount of pleasure, and which should become the standard geography for schools.

Mr. Protheroe has produced a well-arranged treatise on the commercial products of all parts of the world, on communications, towns and markets. His enthusiasm for civilisation and progress gives his style a floweriness which is occasionally overdone, but his book is very readable. It is illustrated by a well-chosen series of photographs, and while not exactly a school-book, should be very useful to teachers of geography and to those numerous persons who wish to make good the deficiencies in their knowledge of commercial geography. We have noticed a few errors, the worst being the derivation of Portland cement from Portland stone (p. 94).

Mr. Symington Grieve recently paid a visit of investigation to Dominica, in the Lesser Antilles, and now gives an interesting account of the island, its natural productions and people, illustrated by photographs taken on his expedition. To anyone intending to visit the island, whether as tourist, naturalist, or trader, the book may be recommended as an excellent guide.

A. M. D.

SOME ASPECTS OF HUMANISM.

(1) *Studies in Humanism.* By Dr. F. C. S. Schiller. Pp. xvii+492. (London: Macmillan and Co., Ltd., 1907.) Price 10*s.* net.

(2) *Lectures on Humanism.* By Prof. J. S. Mackenzie. (The Ethical Library.) Pp. vii+243. (London: Swan Sonnenschein and Co., Ltd., 1907.) Price 4*s.* 6*d.*

(1) LIKE the youth in "Excelsior," Mr. Schiller has a strange device upon his banner, for his motto is "Back to Protagoras." But it is on no solitary or hopeless enterprise that he is engaged, for do not all the most fruitful developments of present-day philosophy point to Pragmatism, and have not all the sages of all times, when they were talking sense, been talking Pragmatism without knowing it? Kant, of course, was of us when he gave primacy to the practical reason and when he announced as his main principle that reality is largely of our making. Even Plato, who here suffers many hard knocks, is perhaps not so complete an intellectualist as he is generally thought, if Prof. Stewart's theory can be substantiated,

"that the so-called Socratic dialogues, so far from being scientifically negligible, are really essential to the complete statement of the Ideal Theory, and should be taken as exemplifying *the function of the Concept in use*, and as supplementing the account of the *abstract* concept given in the dogmatic dialogues, on which alone the traditional descriptions of Platonism have been based."

But after all it is to the strangely misunderstood Protagoras, and his principle that man is the measure of all things, that the world owes most. If only we had his complete works and not fragments—and not Plato's caricature of his philosophy! Then many things would have happened; among others we should not have had the amusing dialogues (containing a prophetic reference to the scholars from Rhodes) which Mr. Schiller has "translated from the Greek" to fill up the gaps in our knowledge.

So it is Intellectualism in all its forms, Platonism, Hegelianism, and that tyrant who has oppressed us so many years—Absolutism—that Mr. Schiller wishes to dethrone. His criticism is always well worth reading. On the other hand, his own system contains not a few features which will give many pause—a God who is essentially finite; a reality which is always incomplete and plastic, in which laws of nature are merely the habits in which things behave; an idea of truth which involves the almost hylozoistic position that inanimate bodies *know* us in some sense (on the level of their understanding) when we operate upon them. The dust of controversy which in this volume beclouds the battlefield will have to settle before it can be decided where most of the truth lies. One wonders—it is genuine Pragmatism to know results before one states principles—what the issue will be; whether the lively Troglodyte of three decades from this will be engaged in proving that new Humanism is but old Absolutism grown more dogmatic and arrogant, or the neo-Absolutist of the period in demonstrating that Absolutism and Humanism are both partial aspects reconciled in a higher unity.

About half the essays contained in this volume have already appeared in a shorter form in various periodicals. But most of the constructive part is new, and the work does not suffer from the manifoldness of the relations in which Humanism is regarded. Certainly, if to be incisive is to be convincing, Mr. Schiller has proved his case.

(2) This volume, containing the Dunkin lectures on sociology, delivered last year at Manchester College, Oxford, runs on very different lines from Mr. Schiller's. No doubt there is the same effort to show how much of Humanism lies implicit in a large range of philosophic works; but as it does not seek to prove a thesis, this book is not written with the same verve and passion. We have sober grey in grey, and never an attempt to bring out violent contrasts. Naturally, Mr. Schiller's Humanism is for Mr. Mackenzie only Pragmatism, but in the few paragraphs devoted to it it receives only reasonable criticism.

Prof. Mackenzie's own Humanism is described as "a point of view from which human life is regarded as an independent centre of interest"—as contrasted with a Naturalism and Supernaturalism which seek the explanation of human life either in the forces around man or in some powers distinct from man and those forces.

In the light of that description the influence of Humanism in philosophy, politics, economics, education, and religion is studied, and the two closing chapters examine the limitations and implications of Humanism. Prof. Mackenzie fears that the style of treatment may be regarded as sketchy; sketchy it is, and the title of the volume perhaps induces expectations that are not realised; but undeniably the work has substantial merits.

OUR BOOK SHELF.

Euclid's Parallel Postulate: its Nature, Validity, and Place in Geometrical Systems. By Dr. J. W. Withers. Pp. x+192. (Chicago: Open Court Publishing Co.; London: Kegan Paul and Co., Ltd., 1905.) Price 4*s.* 6*d.* net.

THIS is a philosophical thesis by a writer who is really familiar with the subject of non-Euclidean geometry, and as such it is well worth reading. The first three chapters are historical; the remaining three deal with the psychological and metaphysical aspects of the problem; finally, there is a bibliography of fifteen pages. Mr. Withers's critique, on the whole, is quite sound, although there are a few passages either vague or disputable. For instance (pp. 80–1): "Had man's spatial experience been confined to vision alone, the struggle between Euclid and Lobatchewsky could never have been, since for vision alone there are no such things as parallel lines." This is not convincing, and the sentence that follows does not add to the force of the argument. As a matter of fact, lines that we see apparently change their inclination as we change our point of view, and diverging lines looked at in a proper direction might very well arouse the concept of parallel lines. And however freely we admit the part taken by sensation in the development of geometrical ideas, we are compelled in the last resort to see that the science of geometry is the

result of a free intellectual construction. Naturally we choose a scheme that with the simplest assumptions harmonises with the greatest number of facts; this is the reason why Euclidean geometry is that of common life. As Mr. Withers points out, there is very little chance of any change in this respect; for if a series of careful experiments upon the stars were to lead to triangles with the sum of their angles different from 180°, we should be more likely to give up the hypothesis of the strictly rectilinear propagation of light than to adopt a non-Euclidean geometry as that of "actual space." On the other hand, we may some time gain experience of a new kind, presenting itself as spatial, and requiring us to assume more than three dimensions in space.

Mr. Withers sensibly steers a middle course between the extremes of pure empiricism and the *a priori* hypothesis. That we cannot form any clear conception of four-dimensional space to which three-dimensional space is related in a manner strictly analogous to that in which a line is related to a plane in which it lies, shows clearly enough that we cannot do without experience; on the other hand, the definition of a surface as a boundary between two adjacent portions of space involves a concept which cannot possibly be deduced from sense-experience, and the recent theory of sets of points gives still more striking examples. Mr. Withers's main contention is that Euclid's parallel postulate is empirical, and this may be admitted in the sense that his argument requires; at any rate, he shows the absurdity of some statements of the *a priori* school.

Die Reizleitungsvorgänge bei den Pflanzen. By Dr. H. Fitting. Pp. xv+157. (Wiesbaden: J. F. Bergmann, 1907.) Price 3.60 marks.

ALTHOUGH the phenomena of irritability in plants are in a general way easily demonstrated, their elucidation is a matter of extreme difficulty, and in spite of the numerous original experiments that have been devised, absolute proof in support of the explanations offered is rarely possible. A notable instance is furnished by the debated question whether the perception of the stimulus of gravity is localised in the tip of the root. The experiments advanced by Charles Darwin in favour of this view were speedily disputed; Czapek's ingenious glass-shoe experiments, although widely accepted as proof, have been adversely criticised, and now more definite proof is hoped to be obtainable by growing seedlings on a rapidly revolving klinostat in such a position that the tip and growing region situated on different sides of the centre of rotation are subjected to centrifugal force acting in opposite directions. The debatable character of the arguments is one hindrance to a study of the subject, to which is added the difficulty of obtaining the literature, scattered as it is through numerous journals and pamphlets.

Dr. Fitting's monograph helps but little in the matter of literature, as in many cases space does not even permit of stating the arguments put forward by investigators, but as a critical guide to the estimation of the various theories his book will be found very useful.

The book consists of three portions, dealing with the occurrence of the phenomena, the path of transmission of the stimulus, and the manner in which it is transmitted. Owing to the absence of descriptions, the first part is only suitable to the reader who has a full acquaintance with the subject or is prepared to look up the literature. The discussions of the various paths by which the stimulus may travel and of the mechanism involved are the most instructive parts of the book, and particular interest attaches to the sections on protoplasmic communications, on the fibrillar structure in cells of the root-apex, and on the electrical phenomena connected with stimulation. Dr. Fitting has himself added materially to the facts of irritability phenomena and their interpretation, so that his opinions are extremely valuable, the more so because he is a searching but unbiased critic.

Birds and their Nests and Eggs found in and near Great Towns. By G. H. Vos. Pp. xii+148; illustrated. (London: G. Routledge and Sons, Ltd., n.d.) Price 1*s*.

To take birds' nests and their contents with the camera is in every way a more satisfactory proceeding than egg-collecting, and if the author of this little volume succeed in aiding the new movement he ought to obtain the gratitude of all bird-lovers—not to mention the birds themselves. Two things are essential in this pursuit: first, the capacity of "spotting" nests, which seems to be an inborn art, incapable of being acquired otherwise, and, secondly, skill in manipulating the camera. In the latter accomplishment the author excels, but for the former he has had to depend on a friend; and the combination of forces has produced most satisfactory results.

The numerous photographs of nests and eggs in their natural sites are all that can be desired, and as regards these no encomiums are too high. We wish we could say the same with regard to the photographs of the parent birds, which, we are told, are taken from "characteristically stuffed typical individuals placed in natural surroundings, illustrating as nearly as possible the conditions under which they were observed." In our opinion these "faked" photographs are thoroughly unsatisfactory, the birds being obviously stuffed (whether "characteristically," in the sense in which the author evidently uses the term, or otherwise), and appearing ill at ease in their pseudo-natural surroundings. The book would be far better without them. As the nests, which include those of a considerable number of species, were all observed within a radius of sixteen miles from the City, beginners whose homes are in large towns need not be deterred by lack of material from following in the footsteps of the author, to whom amateur photographers in general are indebted for showing how much can be done at a comparatively small expenditure of time and money.

R. L.

Kinship Organisations and Group Marriage in Australia. By Northcote W. Thomas. Pp. xvi+164. (Cambridge: University Press, 1906.) Price 6*s*. net.

MR. THOMAS has digested everything that has been written on the Australian natives. In this volume he gives us a very useful *résumé* of all the facts of their complex social organisation, separating the attested from the doubtful—a much-needed piece of work. The account is interwoven with Mr. Lang's theory of Australian kinship and marriage evolution, perhaps the most plausible hitherto advanced, though in the matter of totemic origins it may encounter opposition. Mr. Thomas suggests some real improvements in terminology—matrilocal instead of *beena*, matrilinear and patrilinear, matripotestal and patripotestal—these should be generally adopted, as no doubt they will. The author seems to be at his best in the discussion of such a vexed question as group marriage; the argument is closely reasoned, and brings out several new points. There is an excellent index. The book will be indispensable to anthropologists, and sociologists generally will find it an admirable and convenient text-book for the study of the beginnings of social organisation.

A. E. CRAWLEY.

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.]*

Absorption of the Air for Light of Short Wave-lengths.

In his well-known work on the absorption of the air for light of very short wave-lengths, Schumann has concluded that the opacity is due to oxygen, and that this gas, in thickness of a few millimetres, absorbs *completely* all wave-lengths shorter than about 1800 tenth-metres.

I have recently been investigating the question of gas absorption in this region by means of the vacuum spectroscope which I employed in measuring the lines in the spectrum of hydrogen.

In part my results agree with those of Schumann, for I find that hydrogen, nitrogen, helium, and argon are all quite transparent to very short wave-lengths. In one very important respect, however, I cannot agree with his conclusions, for I find that oxygen is not opaque for *all* wave-lengths below a certain value, but that its absorption is represented by a band with definite limits. With a gas path of nine millimetres and a pressure of one-half an atmosphere, this band extends from 1750 to 1275 tenth-metres.

Though the investigation of the behaviour of oxygen below wave-length 1230 is hindered at present by the opacity of the fluorite windows which enclose the absorption chamber, yet it appears possible that light of even the shortest known wave-lengths may be able to penetrate air paths of more than a centimetre. The application of this result to the behaviour of ether vibrations of extremely high frequency seems important. THEODORE LYMAN.

Jefferson Physical Laboratory, Harvard University, June 21.

The Structure of the Æther.

In the issue of NATURE of June 13 (p. 150) Dr. C. V. Burton raises an objection, raised elsewhere by Prof. Hicks and Sir Oliver Lodge, to the correlation of the magnetic vector with the velocity of the æther, on the ground that the motion of an observer relative to the æther would alter the relative velocity of the æther, and thus produce a change in the magnetic vector in the direction of the change in the observer's motion.

If it were stated definitely that the magnetic force in the free æther was proportional to the velocity of the æther relative to the observer, the objection would be valid; but this is reading into the scheme of the æther more than can legitimately be done. In the discussion the fact has been apparently overlooked that the correlation of the two vectors extends only to their rates of change in space and time, so that if identified with one another at any one point at any one instant, they will be identical at all points at every instant; otherwise they may differ by any constant, corresponding to a uniform but undetermined constant drift of the æther as a whole, or, what is the same thing, to a uniform unknown velocity of the observer through the æther.

But it should be noticed that it is not permissible to speak of the velocity of an observer relative to the æther, as though the æther were a material medium *given in advance*. Even if it were possible to isolate a fixed frame of reference in such an æther—which appears questionable in an infinite continuum—there is no physical means of determining the velocity of a system relative to it. The æther, as we know it, is defined by its electromagnetic properties, and one property is that a uniform drift of the æther as a whole has no effect on electromagnetic phenomena. It is known that the correlation between a stationary and a moving system as regards the electrodynamic equations is exact, and not only correct to the second order. The objection to Prof. Larmor's scheme of the æther does not apply if that scheme is stated accurately as follows:—"The propagation of electromagnetic effects through space, relative to a given frame of reference, may be illustrated by the propagation of disturbances in a rotationally elastic medium, it being possible *for a given frame of reference* to construct such a medium, in which the rotational displacement at any point is proportional to the electric force at that point, and the velocity relative to the frame of a point of the medium is proportional to the magnetic force." Since the velocity of a point depends on the frame of reference, it follows that the media constructed for two frames of reference moving relatively to one another with constant velocity will not be identical. The æther is, in fact, not a medium with an objective reality, but a mental image which is only unique under certain limitations (*cf.* footnote, p. 334, "Æther and Matter"). Two frames of reference imply two æthers; so long as we restrict ourselves to a single frame, the objection to Larmor's scheme does not arise. E. CUNNINGHAM.

St. John's College, Cambridge, June 28.

Root Action and Bacteria.

I do not think that there is necessarily any antagonism between the interesting results which Dr. E. J. Russell has for some time past been obtaining and our observations on the behaviour of trees in heated soil. His deal with the growth of plants, ours with the passage of the plant from the dormant to the active condition, a process analogous to that of germination. Nevertheless, it must be freely acknowledged that, until further work on the subject has been done, the view that bacteria are concerned in the matter is a mere suggestion, and Dr. Russell's opinion that the results may be the consequence of chemical changes produced by the heating is somewhat strengthened by the fact that the soil used was poor in lime, containing only about 1 per cent. CaO. There is, however, one strong objection to accepting an explanation based on chemical change, for two of the nine trees, as I mentioned, behaved exceptionally, and showed practically no retardation in starting. These were two which had been planted in earth heated to the highest temperature, 250°, and were two out of three planted in the same batch of heated earth. It seems impossible to explain these two exceptions if the general results are due to chemical change, but they are easily explained if these results are due to bacterial action, for re-inoculation of the soil might readily occur in one case and not in another.

It may be added that, so far, the trees are behaving normally as to their growth, now that they have once started. SPENCER PICKERING.

I have always carefully looked for, but never found, any retardation of germination in our experiments. The young plants all come up at about the same time, and make equal progress for some weeks; then the plants on the heated soil take on a greener colour, become larger in the leaf and thicker in the stem, and ultimately make about 100 per cent. more dry matter than the control plants in unheated soil. There is no doubt, I think, that bacterial action is involved, because the yield is depressed when I inoculate the heated soils either by watering with unsterilised well water or by adding small quantities of unheated soil. A chemical change in the soil compounds must also be involved, because of the increased "availability" of the nitrogen and phosphorus compounds indicated by the analyses quoted in my earlier letter. All non-leguminous plants we have tried so far have shown similar behaviour.

It is, I think, quite possible to explain Mr. Pickering's results on a chemical hypothesis. In certain circumstances—deficiency of lime among others—organic substances which retard germination and growth may be formed in the soil; in other circumstances, *e.g.* admission of air, they are decomposed by soil organisms. If we assume that some of these substances were formed during the heating of Mr. Pickering's soil, and further assume, with him, that in two pots re-inoculation took place, the poisonous bodies would be destroyed and growth would no longer be inhibited. These assumptions are all based on well-known facts; on this view a soil rich in calcium carbonate should behave as our soils have done and cause no retardation.

However, as Mr. Pickering says, more work is wanted before we can get much further. In the meantime, he has established the very important point that growth may be retarded in a heated soil, and the further development of his experiments will be awaited with much interest.

EDWARD J. RUSSELL.

THE SHAPE OF THE EARTH.[1]

THE most promising suggestion towards a dynamical explanation of the distribution of land and water on the surface of the globe is to be found in the theory of gravitational instability propounded by Jeans in 1903. There is always a tendency in gravitating matter, if homogeneous, to condense towards a centre, or towards an axis, or in some more complex fashion. If the matter is heterogeneous, there is always a tendency for the density to increase where it is above the average and to diminish where it is below the average. Such changes of density imply compression of the material, and they are resisted by the elastic force with which the material resists compression. In the case of a planet we may ask two questions: How small must the resistance to compression be in order that sensible condensations may take place? In respect of what changes of density can instability manifest itself? The answers depend greatly upon the size and mass of the planet, and they depend also upon its constitution.

Whatever the internal constitution of a planet may be, it is certain that, owing to the mutual gravitation of its parts, great stresses will be developed within it. A direct method of attacking the problem of gravitational instability for a planet in such a state of stress was proposed by Lord Rayleigh in 1906. The development of this method leads to the result that a homogeneous spherical planet, of the same size and mass as the earth, could not exist unless the resistance to compression of the material of which it is composed were at least half as great as that of steel. If the resistance were less than a quarter of that of steel (so that the substance was less compressible than mercury but more compressible than glass) such a planetary body would be unstable, both as regards concentration of mass towards the centre and also as regards displacements by which the density is increased in one hemisphere and diminished in the opposite hemisphere. No matter how small the resistance to compression might be, the body would not be unstable as regards any other type of displacements. If the resistance to compression were small enough for a spherically symmetrical state of aggregation to be unstable, the density of the superficial portions would be less than the mean density, and the centre of gravity would not coincide with the centre of figure. If the planet were at rest under no external forces, a shallow ocean resting upon it would be drawn permanently towards the side nearer the centre of gravity, so that there would be a land hemisphere and a water hemisphere.

The average resistance to compression of the materials of which the earth is composed can be deduced from the observed velocity of propagation of earthquake shocks, and it is found to be decidedly greater than that of any known material at the surface—a result clearly associated with the increase of resistance under great pressure. There is, therefore, no tendency to gravitational instability at the present time; but the actual excess of the mean density over the density of surface rocks, and the fact that a very large proportion of the land lies within a great circle having its centre in south-eastern Europe, suggest that the resistance to compression was once much smaller than it is now. This suggestion offers a possible dynamical explanation of the fact that the centre of gravity does not coincide with the centre of figure, and the maintenance of the Pacific Ocean on one side of the globe is due to the eccentric position of the centre of gravity.

[1] Based upon a paper on "The Gravitational Stability of the Earth," by rof. A. E. H. Love, F.R.S., read before the Royal Society on March 14.

The actual shape of the lithosphere, or rocky nucleus of the earth, and its situation relative to the geoid, or the equipotential surface which coincides with the surface of the ocean, are due to many causes, of which the eccentric position of the centre of gravity is one. Other important causes are the rotation and the attraction of the moon. The moon was once very near the earth, and the day and the month were once nearly equal. The earth was then drawn out towards the moon nearly into the form of an ellipsoid with three unequal axes. The direct result of the rotation and the attraction of the moon would be to give to the lithosphere the shape of an ellipsoid differing slightly from the ellipsoidal figure of the geoid. If the centre of gravity coincided with the centre of figure, the lithosphere would protrude from the geoid near the North and South Poles and in two equatorial regions at the opposite ends of the longest equatorial diameter of the lithosphere. If the density were in excess on one side of a diametral plane and in defect on the opposite side, the effects of the rotation, and of those irregularities of attraction which are due to the ellipsoidal figure, would be greater where the density was greater, and the surface of the lithosphere would consequently be deformed in such a way that the deviation from the ellipsoidal figure could be expressed mathematically by means of a spherical surface harmonic of the third degree. The ellipsoidal deviations from sphericity are expressed by harmonics of the second degree, and the eccentric position of the centre of gravity is equivalent to a deviation from symmetry expressed by harmonics of the first degree. We can therefore account theoretically for the presence of harmonics of these three degrees in the formula for the shape of the lithosphere and its situation relative to the geoid.

Now it is known that the actual contour-line at mean-sphere-level (1400 fathoms below sea-level) divides the surface of the globe into two regions of equal area—the continental block and the oceanic region. The continental block is practically continuous, and there are two great ocean basins, one containing the deep parts of the Atlantic and Indian Oceans, and the other the deep part of the Pacific Ocean. A spherical harmonic analysis of the distribution of land and water, account being taken of the submerged portions of the continental block, yields the result that the actual outlines of the great ocean basins at mean-sphere-level coincide very approximately with one of the contour-lines of a certain spherical harmonic containing terms of the first, second, and third degrees, but no terms of any higher degree.

It appears, therefore, that the shapes and relative situations of the great ocean basins, and their positions relative to the polar axis, can be described, at least approximately, in the statement that the lithosphere is an ellipsoid with three unequal axes, having its surface deformed according to the formula for a certain spherical harmonic of the third degree, and displaced as a whole relatively to the geoid in the direction towards south-eastern Europe. The displacement of the surface as a whole is accounted for by the eccentric position of the centre of gravity, and this eccentric position can be regarded as a survival from a past state in which the resistance to compression was too small for a spherically symmetrical configuration to be stable. The ellipsoidal figure is accounted for partly by the rotation and partly as a survival from a past state brought about by the attraction of the moon at the time when the day and the month were nearly equal. The deformation of the ellipsoid according to the formula for a spherical harmonic of the third degree is accounted

for as being due to the interaction of the two causes which gave rise to the ellipsoidal figure and to the eccentric position of the centre of gravity. The main features of the existing division of the surface into continental and oceanic regions can thus be traced to the operation of simple dynamical laws.

PRESENTATION OF THE FREEDOM OF THE CITY OF LONDON TO LORD LISTER.

IN honouring Lord Lister on June 28, the City of London acknowledged the debt humanity owes to the conscientious man of science. Lord Lister was presented with the freedom of the City "in recognition of his eminence as a surgeon, and of the invaluable services rendered to humanity by his discovery of the antiseptic system of treatment in surgery, whereby so great a progress in surgical science has been achieved, so much suffering has been alleviated, and so many valuable lives have been prolonged."

The Lord Mayor attended in state, and among those invited to be present were the President of the Royal College of Physicians, the President of the Royal College of Surgeons, Sir Henry Roscoe and Dr. Charles J. Martin (representing the Lister Institute of Preventive Medicine), Sir F. H. Lovell and Sir P. Manson (representing the London School of Tropical Medicine), Sir Norman Lockyer (representing the British Science Guild), Sir Victor Horsley, Prof. Howard Marsh (University of Cambridge), Dr. L. W. Darra Mair (representing the Chief Medical Officer of the Local Government Board), Sir W. H. Broadbent, Sir William Collins, Sir Frederick Treves, and members of the medical staffs of several of the London hospitals.

Sir Joseph Dimsdale, the City Chamberlain, in admitting Lord Lister to the freedom, remarked :—

A century ago the Corporation of London paid her tribute of honour to the great professions of which Lord Lister is so bright an ornament. In 1803 the Freedom of the City was presented to Dr. Jenner, whose name will ever be associated with the discovery of vaccination, and whose researches superseded the system of inoculation—at that time so successfully and usefully employed to combat the dread disease of small-pox by such men as Dr. Fothergill and Dr. Dimsdale. To-day we meet to do honour to one whose life-long labours mark another epoch in the history of medicine and surgery. During the last half-century the strides made both in medicine and surgery have been little short of marvellous. What was impossible a few years back is now of daily and hourly occurrence. The treatment of disease—the safety in operations—and the careful and tender nursing of the patient are a few of the many developments of our time, and throughout this period Lord Lister has held a foremost place and has been recognised as one of the greatest and most prominent among surgeons. But it is not only as a great surgeon he is known. He is equally a great man of science, and it is by blending his antiseptic treatment with modern surgery that he has made possible so much that has—until lately—been impossible. He stands out as one who has been instrumental in assuaging suffering, lessening disease, and, under God's blessing, prolonging and saving numberless lives. Few are permitted to see the full fruition of their lofty aims and aspirations, but it is with sincere pleasure we greet Lord Lister in this ancient Guildhall, and rejoice to feel that he is able to enjoy the honours conferred upon him by his Sovereign—to be the recipient of universal expressions of esteem and admiration of his work from all seats of learning; while eulogiums from every quarter of the globe proclaim the appreciation the world in general feels for his life-long labours. It remains for posterity fully to gauge and comprehend the magnitude of the legacy he bequeaths to mankind. The City of London—and through her the country—places, I venture to think, the coping stone to-day to the monument of his fame. The citizens, in expressing their deep gratitude for his great services to the human race, ask his acceptance of the highest honour it is in their power to bestow. But while they fully recognise his great work, probably the trait that touches the hearts of his fellow countrymen most is his abnegation of self, and his humble-mindedness, which, amid all his triumphs, recognises that it is under Divine blessing he has achieved so much. Well might Lord Lister in the autumn of his life take to himself the words of Lord Byron :—

> No lengthen'd scroll, no praise-encumbered stone.
> My epitaph shall be my name alone;
> If that with honour fail to crown my clay,
> Oh! may no other fame my deeds repay;
> That, only that, shall single out the spot,
> By that remember'd, or with that forgot.

The name of Lister requires no embellishment, nor is the sculptor's art needed to perpetuate it in posterity. So long as humanity exists, so long as kind and sympathetic hearts beat in the breasts of mankind, so long as the human race is capable of estimating the worth and value of the truly great and good, so long will the name of Lister live, and the memory of him who bears it remain enshrined and held in affectionate reverence by succeeding generations.

Lord Lister in reply said :—

I thank you, Sir Joseph Dimsdale, from the bottom of my heart for your overpoweringly kind words. The work which it has been my great privilege to be engaged in has been its own all-sufficient reward. Perhaps I need not say that I value in the highest degree this, the greatest civic distinction in the world. If it were possible to enhance the honour you have conferred on me to-day this has been done by the extraordinary consideration shown by you, my Lord Mayor, and your Court for my personal convenience. Had it not been for this your extreme kindness it would have been impossible for me in my very infirm state of health to have received your gift here in this historic building.

The 18-carat gold casket in which the freedom was contained bears the following inscription :—

Presented by
The Corporation of the City of London,
with the Freedom of the City,
to the Right Honourable Lord Lister, O.M., M.D., F.R.S., D.C.L., etc.,
in recognition of his eminence as a Surgeon and of the invaluable services rendered to humanity by his discovery of the Antiseptic System of Treatment in Surgery.
Guildhall, E.C., June 28, 1907.

The end panels are decorated with emblems relating to Lord Lister's career, and on the curve of the base a series of figures symbolising scientific research are embossed.

We welcome this well-deserved honour to science, and congratulate Lord Lister upon the latest distinction conferred upon him. Men of science are gratified that the Court of Common Council has shown in such an appropriate way its appreciation of the value of scientific research to the community.

THE EXTENSION OF THE BRITISH MUSEUM.

ON June 27 the King laid the foundation-stone of the new buildings forming an extension of the British Museum. A distinguished company invited to attend the ceremony included Lord Rayleigh, President of the Royal Society, Lord Avebury, Lord Kelvin, Sir John Evans, Sir Henry Howorth, Prof. E. Ray Lankester, Sir Norman Lockyer, and Sir William Ramsay. The Archbishop of Canterbury, as one of the three principal trustees, in his address to the King, detailed the circumstances which had made the extension possible. The origin of the scheme for the extension was described in the address as follows :—

Your Majesty has graciously conferred on the trustees of the British Museum a great honour in being present here this morning to lay the foundation-stone of this, the

first block of buildings of the British Museum extension. The scheme of the extension was initiated twelve years ago, when, in 1895, the opportunity presented itself for acquiring from the trustees of the Duke of Bedford's estate the property immediately surrounding the north, east, and west sides of the museum. At that time your Majesty was a trustee of the British Museum, and your Majesty was pleased to take a great personal interest in the negotiations which resulted in securing the property for the purpose of the future enlargement of this great national institution. This property consisted of the sixty-nine houses forming the western side of Montague Street, the southern side of Montague Place (the site on which this present building is being erected), and the eastern side of Bedford Square and Bloomsbury Street, and covering, with their gardens, an area of 5½ acres. The acquisition of this property, added to the existing museum premises, put the trustees in possession of a four-square area of 13 acres, which, when the scheme of the extension shall be fully carried out, will be covered by the galleries of the completed British Museum of the future. In the negotiations for the acquisition of this property the trustees of the Duke of Bedford's estate met the proposals of the trustees of the British Museum in a most liberal spirit; and the purchase was effected without difficulty for the sum of 200,000*l*., provided by her late Majesty's Government, the Chancellor of the Exchequer then being the late Sir William Vernon Harcourt, himself an elected trustee of the British Museum, who, both on this occasion and on others, manifested his interest in the welfare of the museum by advocating liberal treatment at the hands of the Lords of the Treasury. Five years afterwards, under the will of Mr. Vincent Stuckey Lean, who bequeathed to the trustees of the British Museum the sum of 50,000*l*., "to appropriate at their discretion to the extension and improvement of the library and reading-room," the trustees received the sum of 45,000*l*., being the amount bequeathed, less duty. With this sum in their hands, the trustees again approached the Lords of the Treasury and submitted a scheme for erecting the galleries, of which your Majesty is about to lay the foundation-stone, on the site of the houses forming the south side of Montague Place. There were two reasons suggesting the choice of this site. In the first place, the date of the expiration of the leases of the houses was approaching; and, next, the ground on the north side of the British Museum and contiguous to the library was that which could be most conveniently utilised for complying with the wish of Mr. Lean and devoting his bequest "to the extension and improvement of the library and reading-room." The Lords of the Treasury were pleased to give favourable consideration to the trustees' proposal, with the result that, for the purposes of the new building, the sum of 150,000*l*. was scheduled in the Public Buildings Expenses Act of 1903, in augmentation of the 45,000*l*. which passed to the trustees under the Lean bequest.

In the course of his reply to the address, the King said that during the many years that he was a trustee he took the greatest interest in the scheme for extending the Museum, and he was glad that it had been found possible to acquire sufficient adioining property to allow of a further extension of the buildings in the future.

NOTES.

SIR JOSEPH D. HOOKER, G.C.S.I., F.R.S., celebrated his ninetieth birthday on Sunday, June 30, and received the sincere congratulations of many friends. We are delighted to see that the King marked the occasion by appointing Sir Joseph Hooker to the Order of Merit.

THE long list of honours announced on the occasion of the King's birthday includes the names of a few men of scientific eminence. Prof. E. Ray Lankester, F.R.S., has been appointed a Knight Commander of the Order of the Bath, and Dr. J. A. Ewing, F.R.S., has been appointed a Companion of the same Order. Among the four new peers is Sir James Blyth, Bart., who has rendered signal service to agricultural science, and has placed two farms at the disposal of the Government for the purposes of the investigations undertaken by the Royal Commission on Tuberculosis. With the thirty-one names of new knights are those of Prof. John Rhys, professor of Celtic at Oxford; Dr. J. Donaldson, principal of the University of St. Andrews; Mr. J. Gavey, C.B., engineer-in-chief to the Post Office; and Dr. H. R. Swanzy, president of the Royal College of Surgeons in Ireland, and formerly president of the Ophthalmological Society of the United Kingdom. Sir William MacGregor, K.C.M.G., has been promoted to the rank of G.C.M.G., and Colonel W. G. Morris, C.B., C.M.G., has been promoted to the rank of K.C.M.G. for services as superintendent of the trigonometrical survey of the Transvaal and Orange River Colonies.

MR. W. P. PYCRAFT has been appointed by the principal trustees an assistant on the permanent staff of the zoological department of the British Museum.

THE Anthropological Institute has received the King's permission to change its title to that of the Royal Anthropological Institute of Great Britain and Ireland, by which name it will henceforth be known.

SOON after 9 a.m. on June 26 Holyhead and other places in the western part of the Isle of Anglesea experienced an earthquake shock which greatly alarmed the inhabitants, and in some instances threw down pictures and crockery. The shock was accompanied by a noise like thunder, which lasted about twenty seconds. The vibration is stated to have come from the north-east.

THE council of the Royal Society of Edinburgh has awarded the Keith prize for the biennial period 1903–5 to Dr. Thomas H. Bryce for his two papers on "The Histology of the Blood of the Larva of *Lepidosiren paradoxa*," published in the Transactions of the society; and the Makdougall-Brisbane prize for the biennial period 1904–6 to Dr. Jacob E. Halm for his two papers on "Spectroscopic Observations of the Rotation of the Sun" and "Some further Results obtained with the Spectro-heliometer," and for other astronomical and mathematical papers published in the Transactions and Proceedings of the society.

THE Lord Mayor presided over a meeting convened by the Bread and Food Reform League at the Mansion House on June 26. This league is organised to direct attention to the great importance of the food question, to promote the healthy nutrition of the people, and to diminish many of the diseases produced by ignorance of dietetic laws. Without advocating any special system of diet, it is desired to show the nutritive and economic importance of many neglected foods of staple value. It is believed that proper knowledge of the food value of various diets will promote health and temperance, and diminish the fearful infant mortality that exists at the present time. The meeting was addressed by the Lord Mayor, Miss May Yates (the hon. secretary of the league), Sir James Crichton-Browne, Dr. Heron, Dr. J. F. Sykes, Mr. Mayo Robson, and others.

IN reply to a question asked in the House of Commons on Monday, Mr. Haldane stated that the names of the members of Lord Rayleigh's committee now considering questions arising out of defective cordite are as follows:—

Lord Rayleigh, F.R.S., Sir J. Dewar, F.R.S., Sir A. Noble, Bart., F.R.S., Sir W. Crookes, F.R.S., Dr. J. A. Ewing, F.R.S., Dr. A. Dupré, F.R.S.—absent through illness; Major-General D. D. T. O'Callaghan, president, Ordnance Committee; Rear-Admiral R. F. O. Foote, vice-president, Ordnance Committee; Lieut.-Colonel Sir F. L. Nathan, superintendent, Royal Gunpowder Factory; Captain B. H. Chevallier, assistant to Director Naval Ordnance; Captain J. H. Thomson and Major A. McN. C. Cooper Key, H.M. Inspectors of Explosives, Home Office; and Mr. R. Robertson, superintendent in Chemist Research Department.

THE New Zealand Government is about to undertake extensive trawling of an experimental nature. Mr. L. F. Ayson, Chief Inspector of Fisheries, will be in charge, and Mr. Edgar R. Waite, curator of the Canterbury Museum, Christchurch, has been appointed zoologist to the expedition. Collections will be made of all marine products, which will be investigated, so far as possible, by New Zealand naturalists, and the material obtained will be the property of the Canterbury Museum. The committee for biological and hydrographical study of the New Zealand coast, appointed by the Australasian Association for Advancement of Science, will provide certain equipment for use in the deeper waters. The *Nora Nevin*, a new steam trawler just from the stocks at Grimsby, England, built to the order of the Napier (N.Z.) Fish Supply Co., has been chartered by the New Zealand Government, and it is anticipated that operations will extend over a period of three months.

THE annual general meeting of the Society of Arts, the 153rd since the foundation of the society, was held on June 26, Sir Steuart Colvin Bayley, K.C.S.I., C.I.E., chairman of the council, being in the chair. The Prince of Wales was re-elected president of the society, an office which he has filled since 1901. It was announced that a committee has been appointed to make further investigation into the subject of the deterioration of paper, on which subject a committee reported in 1898. The council of the society is prepared to award, under the Fothergill trust, a gold medal, or a prize of 20*l*., for the best portable apparatus or appliance for enabling men to undertake rescue work in mines or other places where the air is noxious. Inventors intending to compete should send in a notice of their intention, together with a full description of their inventions, not later than March 31, 1908, to the secretary of the Society of Arts, John Street, Adelphi, London, W.C.

WE regret to see the announcement of the death, on June 28, at the age of eighty-two, of Sir William T. Gairdner, K.C.B., F.R.S., formerly professor of medicine in the University of Glasgow. Sir William Gairdner graduated as M.D. at the University of Edinburgh in 1845. He made numerous contributions to the science of medicine, more especially in the departments of pathology, public health and hygiene, and clinical medicine. He was recognised as one of the foremost physicians of his time, and his status in the medical profession is indicated by the fact that he was president of the British Medical Association in 1888. For several years he acted as the first medical officer of health for the City of Glasgow, and the measures he then initiated for securing the health of the community soon materially lowered the death-rate of the city, and have been adopted largely at home and abroad. Sir William Gairdner was appointed K.C.B. in 1889, and was elected a Fellow of the Royal Society in 1893. Among other distinctions, he received the degree of LL.D. Edin. in 1883, and that of M.D. Dublin (*honoris causa*), with the honorary Fellowship of the Royal College of Physicians of Ireland, in 1887. His principal works were "Clinical Medicine," 1862; "Public Health in Relation to Air and Water," 1862; "On some Modern Aspects of Insanity," "Lectures to Practitioners" (jointly with Dr. J. Coats), 1888; "The Physician as a Naturalist," 1888; and many papers in medical journals and in the transactions of pathological and medical societies.

THE death of Dr. Carl Braun, S.J., which we regret to have to announce, recalls the earnest efforts that Hungary has made of late years to assume a more prominent position in astronomical science. The late Archbishop of Kalocsa, who provided and equipped the observatory of that town, placed it under the charge of Dr. Braun, and here he worked indefatigably in those preliminary matters which are so necessary in a young institution. He mounted the instruments, determined the position of the observatory, and decided the course of future observation, which under Father Fenyi has been productive of such fruitful results. As a pupil of Secchi, he naturally turned to spectroscopic observation of the sun, and in this department the work of the observatory is well known. Such questions as the density of the earth also occupied him, and in the later years of his life he contributed papers on cosmogony. Indeed, his activity ranged over many subjects, and though he suffered much in the later years of his life, his colleagues speak of his untiring industry and continued perseverance. Dr. Braun was possessed of great mechanical ingenuity. This was manifested in the construction of, or rather suggestion for, a form of transit micrometer that reduced personal equation to a minimum, and of a plan for photographing the sun by monochromatic light, forestalling by many years the work of Hale and Deslandres.

THE annual meeting of the general committee of the Imperial Cancer Research Fund was held on Monday at Marlborough House, the Prince of Wales presiding. In moving the adoption of the report, Sir William Church said:—Our knowledge of the existence and frequency of cancer in various races of men is steadily increasing, and evidence is accumulating that its presence is not infrequently associated with native customs or religious rites which act as sources of chronic irritation of portions of the surface of the body and appear to determine the character and position of the cancerous growths most commonly met with. The information we have received lends no support to the view that cancer is associated with any particular kind of diet; populations living on a purely vegetable diet are apparently as subject to it as those whose food is of a mixed character. Resort to experiment must be had in order to trace more accurately the circumstances associated with the spontaneous occurrence of cancer both in individuals and in families. The removal by surgical means of cancerous tumours occurring spontaneously in mice prolongs their lives and has enabled us to breed from them; we have, therefore, now the means of observing descendants of mice of known cancerous parentage, and by successively crossing other spontaneously affected animals with the offspring of cancerous parents, we can concentrate the hereditary tendency, if it exists. This concentration in large numbers of animals of a known age and in a known amount should enable us, in the course of a few years, to determine whether there is a family or only an individual tendency to the disease. Other experimental investigations have

been carried on; in former years we endeavoured by experiment to find out the essential features of cancer; during the past year we have been engaged in studying special problems, and more especially the relations of cancer-cells to those of the organism in which they occur. Considerable attention has been paid during the past year to the alleged cures for cancer which have come before us. I regret to say that it is impossible to ascribe a curative value to any of them. A further series of experiments with trypsin alone, or in conjunction with amylopsin or as pancreatic extract, have been made, and it appears in mice to exert no effect on the growth or development of the tumours.

WE have received from Mr. Quaritch, of Grafton Street, a copy of the third part of a catalogue of rare and valuable works on natural history. The contents include works on various groups of invertebrates, on palæontology and geology, and on general biological subjects.

SUPPLEMENTAL notes on the mammals and a list of the myriopods of the Forth or Edinburgh area constitute the contents of No. 8 of vol. xvi. of the Proceedings of the Royal Physical Society of Edinburgh, both papers being by Mr. W. Evans. The additions to the mammal list include a bat and the Greenland, or harp, seal, a specimen of the latter having been taken in March, 1903, in the upper estuary of the Forth.

WE have received copies of Nos. 1530–6 of the Proceedings of the U.S. National Museum. Among these, reference may be made to reviews of the loaches and sticklebacks of eastern Asia, by Mr. L. Berg (Nos. 1533, 1536), in which it is shown that *Misgurnus fossilis* (loach) and *Cobitis taenia* of the British Isles are represented by specifically identical forms in the Amur. The description of a new genus (Spherarmadillo) of terrestrial isopod crustaceans from Guatemala, by Miss H. Richardson (No. 1535), is also a matter of considerable interest.

IN his report for 1906, the director of the Field Museum of Natural History, Chicago (the new title of the Field Columbian Museum), has to deplore the death of its founder, Mr. Marshall Field, which took place during the year under review. Mr. Field, although he held no official post in connection with it, was a constant visitor to the museum, where his commendation was always regarded by the officers as a high honour. In all departments the museum appears to be making steady progress, several new acquisitions and exhibits being illustrated in the report. Among the former, attention is directed to a series of meteorites from a recent fall in Kansas, and to a large number of vertebrate remains from the Loup Fork beds of Nebraska and Wyoming.

IN connection with the preceding paragraph, reference may be made to the valuable series of catalogues of mammals compiled by Dr. D. G. Elliot, honorary curator of the zoological department of the Field Museum, Chicago, and published by the museum. While the previous volumes deal with the mammalian faunas of America, the one now before us is a catalogue of the specimens of mammals from all parts of the world in the collection of the Field Museum. Although simply a catalogue, with references to original descriptions, the volume contains a number of excellent illustrations of striking types of mammals, many of which students familiar with the subject will recognise as reproductions from well-known figures. The collection of mammals in the museum, now comprising about 15,000 specimens, has been mainly brought together by the energy of Dr. Elliot, and every specimen, with its full history, is catalogued in the present volume. Whether Dr. Elliot's views or nomenclature, be generally accepted in their entirety or no, the work cannot fail to be of great value to naturalists, and the entire series of catalogues forms a monument to the untiring and ceaseless industry and perseverance of the author.

IN the Scientific Memoirs of the Government of India, No. 27, Captain Patton, M.B., I.M.S., records the frequent occurrence of the Leishman-Donovan body in the peripheral circulation in cases of kala-azar in Madras, the parasite being seen in the leucocytes but not in the red blood cells nor free in the plasma. In certain cases of the disease, accompanied with extensive ulceration of the large intestine, the polymorphonuclear leucocytes are increased in number, and many of these cells contain the parasite. The parasite was recovered from certain lice allowed to bite patients, but not from several mosquitoes nor from a tick. In the Indian bed-bug (*Cimex macrocephalus*) the parasite was found in considerable numbers, and all stages of development, from the round body to fully developed flagellates, were observed. In Memoir No. 28, Captain Christophers, M.B., I.M.S., describes the sexual cycle of development of the hæmogregarine parasite of the dog, the *Leucocytozoon canis*, in the tick, *R. sanguineus*. Soon after the tick has ingested blood containing the parasites, free vermicules appear; some of these become embedded in the protoplasm of the gut cells and become stouter and more bulky. The bulky forms undergo fission into two, four, or even eight vermicules, some of which are large and sexually mature, conjugate, and form oocysts. The protoplasm of the oocyst then divides into sporozoits, but the means by which these reach and infect the dog have not been made out, as they have not been found in the ova of the tick.

A BOTANICAL exploration of the north-western portion of the county of Limerick, comprising the barony of Shanid, undertaken by Messrs. M. C. Knowles and C. G. O'Brien, has yielded several interesting plants and added many new species to the flora of the district. An account of their collections appears in the *Irish Naturalist* (June). Two notable discoveries were the grasses *Glyceria Foucaudi* and *Glyceria Festucaeformis*. A variety of *Rosa stylosa* was found in apparently native surroundings, and the same opinion is expressed with regard to the habitat of *Epilobium angustifolium*.

ON the reproduction of trees from seedlings, a problem that offers peculiar difficulties to foresters in a hot, dry climate, several articles appear in the *Indian Forester* (April). The requirements of "sal" seedlings, *Shorea robusta*, with regard to soil, protection from frost and light are discussed by Mr. W. H. Lovegrove and Mr. E. M. Coventry, and Mr. L. S. Osmaston refers to experiments in connection with artificial methods for raising young trees. The discovery noted by Mr. E. P. Stebbing of the coccid *Lecanium capreae* on almond trees in Baluchistan provides the first record for India. A useful summary, by Dr. E. Nesbit, of Indian trees providing timber suitable for export is concluded in this number of the journal.

ON the subject of the interrelation between the phases of the moon and the cutting of bamboos and other material, a correspondent writes to say that in Mexico and other American countries the belief is commonly and strongly held that material should be cut when the moon is waning if durability is desired. The statement is advanced

on the evidence of an American ranchman, who offers the explanation that at the time of the full moon the bamboos are full of sap, and that the sap rises and falls with the waxing and waning of the moon. As mentioned in a paragraph in NATURE of February 14 (p. 377), Mr. E. P. Stebbing has met with the same belief in India, and refers to experiments made in southern India, but these were inconclusive. Seeing how widely the conviction is spread through the tropics, it would be interesting to obtain more evidence, but such evidence should be based on a systematic and carefully planned series of experiments.

FROM the *Agricultural News* we learn that the cultivation of new seedling sugar canes, as compared with the Bourbon and other varieties hitherto grown in British Guiana and elsewhere in the West Indies, shows considerable progress in recent years. From returns to hand, it appears that 28,801 acres were planted in British Guiana in seedling canes in 1906–7. The area in 1905–6 was 14,743 acres, and in 1904–5 9518 acres. Among the more important seedling varieties are the Demerara seedlings D. 109 and D. 625, while two Barbados seedlings, B. 208 and B. 147, are also largely cultivated. It is pointed out that an editorial note which appeared in the *International Sugar Journal* in May last (pp. 219–220) discussing the "Identity of Seedling Canes in Demerara," and stating that the seedling cane B. 208 cultivated on the well-known Diamond Plantation in Demerara "was not the original seedling of that variety," is without foundation. Samples of B. 208 from Diamond Plantation have since been submitted to a critical examination by the Imperial Department of Agriculture for the West Indies, and it is stated that they are identical with the original seedlings of that variety raised at Barbados.

THE Engineering Standards Committee has issued a new edition of the British Standard Specification for Portland Cement (report No. 12, price 2*s.* 6*d.*). Several alterations have been made with the view of extending the usefulness of the specification. The percentage of sulphuric anhydride has been slightly extended, the expansion under the Le Chatelier test has been reduced, and the maximum final settling time for the slow-setting cement has been increased. Other alterations have been made in the direction of rendering the meaning of the specification more clear.

ONE of the most interesting phases of the development of copper mines caused by the recent great demand for the metal and by the use of electric power has been the profitable mining of ores so poor that formerly they would have been regarded as valueless. A striking example of this is afforded by the mines of the Boundary District, British Columbia, which are described in detail by Mr. F. Keffler in a copiously illustrated article in the *Engineering Review* (vol. xxxiii., No. 3). In the same issue there are well-considered articles on efficiency in the burning of fuel under the steam boiler, by Mr. W. D. Ennis, and on the design of modern producers and gas engines, by Mr. R. E. Mathot.

WITH the *Engineer* of June 21 is issued a special supplement devoted to auxiliary machinery on merchant steamers. It contains seventy illustrations, and shows in a striking manner the remarkable changes that have been effected within recent years. The development of electricity on board ship for power purposes, as well as for lighting; the adoption of the turbine principle of propulsion for cross-Channel and ocean-going passenger steamers; the increase in the number and size of dead-meat carrying steamers; and the radical modifications in the general design and equipment of ships engaged in bulk-cargo carrying, with the view of extreme despatch in loading and discharging—all these are matters which have had distinct influence of late in modifying conventional and standard facilities and practice in respect of steamship auxiliary machinery.

THE *Mitteilungen* of the Berne Philosophical Society for 1906 contain observations of twilight phenomena and of the intensity of the magnificent Alpine glows at that place during the year, by P. Gruner. The glows were more frequent than usual, owing probably to the abnormally fine weather, but the cases of great intensity of colour were below the average. In "The Glaciers of the Alps" Tyndall pointed out that "the colouring must, in a great measure, be due to some variable constituent of the atmosphere"; we are glad, therefore, to learn that the author proposes to discuss the observations published since 1903, after at least a five years' series is available.

THE Egyptian Survey Department has decided to separate the meteorological work into two parts, the first dealing with the observations at Helwan Observatory and the second with the climatological stations, rainfall, and river data. These observations have now been published for 1904, and the reports for 1905–6 are promised shortly. Part ii. contains, in addition to the results of observations at the various stations in Egypt and the Soudan, a sketch of the climate of Egypt condensed from the discussion in "Physiography of the River Nile and its Basin," by Captain H. G. Lyons (see NATURE, vol. lxxv., p. 17). The chief climatological feature of the year 1904 is said to have been the failure of the north-east African monsoon, which was both late and weak. In Egypt itself the noteworthy features were the abnormally cool weather of spring and warm spell in October.

DR. G. PANCONCELLI CALZIA, of Marburg, is publishing in the *Medizinisch-pädagogische Monatsschrift* a summary of current literature on phonetics under the title "Bibliographia Phonetica." As the author points out, it has been necessary for specialists in this subject to consult literature extending over a wide range of other sciences in order to find the papers they want, the only guide in existence being the somewhat incomplete summary of the period 1876–1896 by Breymann. Dr. Calzia desires to receive copies of all papers or books bearing on phonetics for the purpose of abstracting, and rare and valuable books will be returned if desired.

A VERY suggestive article on the progress of our knowledge of the flora of North America is contributed to the *Popular Science Monthly* for June by Prof. L. M. Underwood. It is illustrated by figures reproduced from the early works of Porta (1591), Bock (1587), Cornut (1635), Plukenet, Micheli (1729), and Linnæus (1753). Perhaps the most noteworthy point emphasised in the article is the comparatively recent development of botany as a subject of university study. The late Prof. Asa Gray appears to have maintained a conservative spirit in regard to the study of systematic botany, and to have shown opposition to those who might have helped in the vast field of work required to be done. Thirty years ago America possessed only three professors of botany, and one Government botanist at Washington; now, both in the universities and in the Government stations, the botanists can be counted by hundreds.

UNDER the title "Tablettes des Cotes," M. Gaston Tarry publishes a triple entry table for the purpose of finding the prime factors of large numbers which are not

divisible by 2, 3, 5, or 7. For this purpose the number in question is first expressed in the form $m.\ 20580 \pm (q\ 2{\cdot}10 + r)$. The tables headed with the numbers (Tablettes grillés) have slots cut in them which are placed over the columns headed with the columns r, and by following certain rules according to the sign in the above form, and noticing whether the figures ("cotes") in the subsequent lines of the columns are in dark or light type ("cotes grasses" or "cotes maigres"), it is possible to ascertain which of the prime numbers in the next adjoining column of the open tables are factors of the original number. We have verified the method, but the rules are a little difficult to apply at first. The tables are published by Gauthier-Villars, of Paris.

REFERRING to our note on the scientific uses of the kinematograph (NATURE, May 23, p. 87), Mr. W. F. Cooper, of Water Lane, Watford, writes pointing out the difficulties experienced by amateurs in obtaining sufficiently rapid films for the purposes of research. The fastest films he has been able to obtain have a speed of H. and D. 100, less than half that of ordinary snapshot plates. This speed is quite inadequate for the photography of operations, for in a case observed by Mr. Cooper an exposure of ten minutes would have been required. Mr. Cooper has been successful in recording the movements of blood corpuscle parasites, but the chief obstacle in the way of further progress is lack of general interest in the uses of the kinematograph on the part of scientific workers as opposed to professionals. He invites correspondence with others who have taken up this line of work with the view of producing a demand for films better suited to the purpose in the matter of speed and orthochromatic properties.

A SIMPLE lecture experiment to demonstrate the transformation of yellow phosphorus into the red variety is described by F. Zecchini in the *Gazzetta* (vol. xxxvii., i., p. 422). Ordinary dry phosphorus is melted in a glass tube 30 cm. long and 7–8 mm. in diameter by surrounding the tube with a bath of concentrated sulphuric acid the temperature of which is gradually raised to 180°. Sufficient phosphorus should be used to give about 10 c.c. of liquid. When the whole has melted, a minute crystal of iodine is added; as the crystal falls through the molten mass the immediate transformation of the latter into red phosphorus becomes clearly visible.

MESSRS. R. AND J. BECK, LTD., have published a pamphlet by Captain Owen Wheeler on "Telephotography Simplified for Naval, Military, and General Purposes." The price of the pamphlet is 1*s.* 3*d.*

OUR ASTRONOMICAL COLUMN.

COMET 1907*d* (DANIEL).—The daily ephemeris computed by Dr. E. Strömgren for comet 1907*d* is given up to July 10 in No. 4185 of the *Astronomische Nachrichten* (p. 155, June 21). The following is an extract therefrom:—

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

1907	α (true) h. m.	δ (true) ° ′	Brightness
July 4 ...	1 4·3	+5 0 0	
,, 6 ...	1 11 2	+5 31·1	1·94
,, 8 ...	1 18·3	+6 2·1	
,, 10 ...	1 25·5	+6 32·9	2·17

An observation at Strassburg on June 17 gave corrections of +4*s.* and +0′·4, and the magnitude was estimated as 8·5 or 9·0. On that date the brightness, according to the ephemeris, was about 1·1. The apparent path as shown in the above ephemeris lies roughly between 80 and μ Piscium, and the comet now rises shortly after midnight.

PECULIAR SPECTRUM OF ϵ CAPRICORNI.—A note by Mr. V. M. Slipher, of the Lowell Observatory, on the spectrum of ϵ Capricorni (magnitude = 4·5) appears in No. 4, vol. xxv. (p. 285, May), of the *Astrophysical Journal*. Spectrograms taken last autumn showed bright lines, and more recent ones show that the hydrogen lines are paired—a dense dark line with a weak bright line above it. The dark hydrogen and the metallic lines indicate a radial velocity of about 45 kilometres for October 8, but on October 27 this had decreased to 35 kilometres, the lines being displaced towards the red. Broad and diffuse helium absorption lines are also shown, but do not participate in the displacement towards the red; in fact, measures of some of the sharper ones show a slight "shift" towards the violet, and it therefore seems possible that these, with the bright hydrogen lines, belong to one member of the system, whilst the dark hydrogen and the metallic lines belong to the second.

ATMOSPHERIC CURRENTS IN CELESTIAL BODIES.—A paper on the causes which produce different currents in the atmospheres of celestial bodies, such as Jupiter and Saturn, is published by Senor José Comas Solá in No. 4185 (p. 145, June 21) of the *Astronomische Nachrichten*. Senor Solá calls in the tide-raising effects of very small satellites revolving in close proximity to the primary to account for these atmospheric currents. Taking Jupiter as an example, these hypothetical satellites produce an accelerating effect in the superficial layers of the atmosphere near to the equator. The larger, more distant satellites produce a much deeper, retrograde current extending further from the equator, whilst in the circumpolar regions we see the normal rotation of the planet. Thus we get the shortest rotation period in the equatorial currents, and the slowest motion in the intermediate latitudes, where only the retrograding effect of the larger satellites is operating. This superposition of layers may account for the occasional passage of a mass of dark matter below the Red Spot, for, by the hypothesis, the latter, a superficial disturbance, is in the slower moving layer of the intermediate latitude, whilst the dark matter is a much deeper disturbance reaching down to the more quickly moving normal layer of the planet's atmosphere. Similarly, the proximity of rings of ponderable matter to Saturn and the sun may be held to account for the differential velocities observed in different zones of the atmospheres of those bodies.

OBSERVATIONS OF PLANETS.—In an account of the observations made on the summit of Mont Blanc during the period August 31 to September 5, 1906, MM. Hansky and Štefánik give details of their observations of Venus, Mercury, and Jupiter, made under nearly perfect atmospheric conditions. Difference in the markings seen near the poles of Venus and alterations in the contour of the terminator suggested a rotation of the planet, a suggestion which was apparently confirmed by the re-appearance of the same aspects after a lapse of nearly twenty-four hours. The two sets of observations made on September 3 and 4 gave the apparent rotation period as 23h. 20m. and 23h. 25m. respectively. Three dark spots, one at the middle of the terminator and two smaller ones near to the eastern limb of the planet, were seen on Mercury on September 5 at about 5h.

Numerous details of the observations of bands and spots on Jupiter are also given (*Comptes rendus*, No. 23, p. 1252, June 10).

THE MELBOURNE OBSERVATORY.—According to the report of the director, Mr. P. Baracchi, the astronomical work of the Melbourne Observatory for the period April 1, 1905, to November 30, 1906, was practically limited to meridian observations and the work for the Astrographic Catalogue. For the latter, the total number of satisfactory plates obtained was 191, of which ninety-three were triple-exposure chart plates and thirty-two were for the duplicate series of the catalogue; these bring the respective totals up to 588 and 487. The measuring bureau is the joint affair of the New South Wales and Victoria Governments, and the total numbers of plates measured to date are:—for Sydney, 551, containing 322,101 stars; for Melbourne 836, containing 268,714 stars.

PAWNEE TRADITIONS.[1]

SOME time ago Mr. Dorsey, who is curator of anthropology at the Field Museum of Natural History, Chicago, undertook a series of investigations among the North American tribes of the Caddoan stock, to which the Pawnee among other Indians of the plains belong. The investigations were begun on behalf of the Field Museum, and have been continued for the last four years under the auspices of the Carnegie Institution. Of the results, one volume has been issued by the American Folklore Society, some detached articles have been published in the Journal of the same society and the *American Anthropologist*, and the present is the fourth volume issued by the Carnegie Institution. All materials in volume form are composed of traditional narratives, and it may at once be said that they form an important contribution to our knowledge of the aborigines.

A collection of native tales as extensive as that in the volume before us (it contains 546 quarto pages and 148 tales of varying length) must of necessity reveal incidentally much of native custom and belief. Especially is the religion abundantly illustrated, since many of the stories are connected either with the sacred objects or the sacred ceremonies. They profess to explain the origin of these, and are told, as a rule, only during the ceremonies. Moreover, they afford glimpses of the social organisation of the tribes and of their amusements, as well as of their more serious business of hunting and fighting. Pawnee is a word said to mean wolves, and the Pawnee were as noted for their bravery, their endurance, their skill, their untiring activity and relentless character as the animals the name of which they were proud to bear. Their religion was most actively concerned with the animals with which they came into contact. These animals were supposed to be organised in much the same way as themselves, and such of them as were articles of food were believed to give themselves willingly to mankind, always provided that they were treated with ceremonial respect and that dances and other rites were performed from time to time in their honour. From them and other animals human beings received magical gifts and more than natural powers if they obtained by prayer and fasting the favour of the chiefs of the animal lodges. Above the animals were a number of superior beings called "gods," most of them more or less vaguely conceived. At the head of the pantheon stood Tirawa, a quasi-creator, whose authority all the others acknowledged.

The word "mythology" on the title-page is a somewhat unfortunate choice. On the one hand, we do not get in this volume so complete a view of what may be called the sacred history of the Pawnee, apart from the origin of medicine ceremonies, as in Mr. Dorsey's previous work on the "Traditions of the Skidi Pawnee." On the other hand, many tales are included which can only be called mythology by an illegitimate extension of the meaning of that word. Such tales are not connected with the religion of the tribe, nor are they believed to be true. They are often concerned with the lower animals; and they correspond partly to our fairy-tales and partly to our apologues. Speaking of the stories in general, it may be said that the most superficial reader will at once recognise that in plot and incident they are to a large extent similar to those of the surrounding and allied peoples, are conditioned by their mode of life, and are peculiar to North America. At the same time many of the incidents, and sometimes whole chains of incident, are common to humanity. To mention only a few, we have the incident of the Magical Flight and Pursuit, the Task of Recognition to be performed by a husband who comes to find his bride, the story of Orpheus and Eurydice, the Swan-maiden Bride, the Transformation Fight. In the form in which they are presented they are so thoroughly native to the soil that it cannot be suggested that they are due to European intercourse. But in any case the old wild borrowing theory has long been given up as discredited. While it is admitted on all hands that transmission of stories does take place, students who are interested in the question seek proofs of transmission within saner limits.

The second part of the work is not yet published. It is intended to include the music and text of the songs referred to, or given only in a free translation, in the present volume. It will also comprise a comparative study of the tales and incidents, in which they will be treated in their relation to "the tales of other tribes of the so-called Caddoan stock," and, indeed, to those of other American Indians. This is a very necessary complement to the author's other investigations. It is to be hoped he will also find opportunity then or very soon for a fuller description of the social organisation, the rites and beliefs of the stock than he has hitherto given. We want to know, for instance, what are the marriage-rules of the tribes, whether descent is traced in the male or the female line, what their clan-organisation is; we want full descriptions of their ceremonies, their taboos, and so forth. As already intimated, something may be gathered from the stories, but our inferences may be right or wrong; we need authoritative statements. Mr. Dorsey is so well qualified by life-long study, and by his eminence among American anthropologists, and he has given us in these collections of Caddoan traditions so much of interest and value, that he will pardon our demanding a key that shall unlock what at present remains closed. Our thanks to him are heartfelt, but they partake very largely of that gratitude which is a sense of (or at least an earnest hope for) favours to come. E. SIDNEY HARTLAND.

[1] "The Pawnee Mythology." Part i., Collected under the Auspices of the Carnegie Institution of Washington. By George A. Dorsey. Pp. 546. (Washington, D.C.: Carnegie Institution, 1906.)

PLANT DISEASES AND REMEDIES.

THE experiment station of the Hawaiian Sugar Planters' Association has issued as Bulletin No. 5[1] a remarkable publication which not only deals in a very comprehensive and thorough way with the fungus enemies of the sugar-cane, but also contains a series of valuable notes on associated insects and nematodes.

The volume has bound with it also Bulletin No. 4 of the same station, and by the same author. This bulletin is on some elements of plant pathology. In the course of the work mention is made of new blights found in the cane-fields of Hawaii, and of the new and threatening aspects of blights already known.

Part i. is introductory, and may be passed over. Part ii. deals with the root disease of sugar-cane. In this section, which covers eighty-five pages, we have a most accurate and interesting description of the strange Ithyphallus fungus, which is one of the causes of root disease. "Time alone can show," Mr. Cobb tells us, "what the relative importance of the Ithyphallus fungus will be among the root-diseases of cane." The serious losses caused by the fungus and its early history are first traced, and then the extraordinary fructifications are detailed and admirably illustrated. Then follows an account of the relations of insects to Ithyphallus. The author tells us that five species of flies, a beetle, and an ant frequent the fresh fructifications, and that some of the flies are so passionately fond of the sticky dark-green spore-mass that they can scarcely be driven away.

Dispersal of this fungus by their agency, especially in the excreta, is proved, and although the flies are not named generically, they were known to be Sarcophagidæ and Muscidæ. The work done in this subject is remarkable. It was shown that the spores are also carried in numbers on the feet. The spores from five of the fly tracks on glass were found to be 860,000 per track. Then follow notes on digestive power of flies, notes on defection (the number of spores found in a "fly-speck" was shown to be 22,400,000 in some instances); even the weight of a fly ration is gone into with wonderful exactness.

The use of lime as a fungicide is pointed out, and methods of cultivation given.

Parts iii. and iv. deal with the leaf-splitting blight and rind disease; the first-named is shown to be due to Mycosphærella. The pine-apple disease (*Thielaviopsis ethaceticus*) and the relation of certain insects and mites to it is detailed, and also the well-known yet little under-

[1] "Fungus Maladies of the Sugar Cane." By N. A. Cobb. (Honolulu: Hawaiian Gazette Co., Ltd., 1906.)

stood Eleau disease. Various experiments in the preparation and disinfection of cane cuttings and in testing cane varieties for their resistance to disease that have been carried out are recorded, and should prove most helpful to growers.

The ninth and concluding section deals with free-living nematodes inhabiting the soil about the roots of cane and their relation to root diseases. The root diseases are very serious, and in these soil-inhabiting nematodes we have organisms capable, through their punctures, of giving entrance to smaller parasitic organisms that would hasten the death of the plant roots.

The author describes no less than eighteen new species of these worms, and records five more found around the roots of diseased canes in Hawaii. They are included in the genera Dorylaimus, Tylenchus, Mononchus, Prismatolaimus, Cephalobus, &c., and one new genus, Anthonema, is described.

The whole work is excellent in every respect, not only from an economic point of view, but as an example of the thorough way in which such scientific investigations should be carried out.

The sixth report of the Woburn Experimental Fruit Farm deals with various washes used for the destruction of injurious insects.[1] Among the more important experimented with were the alkali washes, paraffins and emulsions, lime-sulphur and others in connection with the destruction of the mussel scale (*Mytilaspis pomorum*). The portion of the report dealing with the paraffin oils and emulsions will prove of great value, and also from a scientific point of view much else in the report. But some of the results do not at all agree with what growers have found, such, for instance, that lead arsenate wash badly scorches the leaves under certain conditions and at certain strengths. It has not, it seems, been found to do so in their hands.

Some interesting work on silver leaf is given in conclusion. As a scientific chemical work it is all that could be desired, but the reader must take certain results with care, for if "egg-counts" have been made taking into account the following sentence, "we certainly found a greater destruction of eggs by insecticides in the case of scales which had been thus bored (by Chalcididæ), than of those which were intact," then we must discount some of the results obtained. Some of the opening remarks might with advantage have been excluded by the authors.

But in spite of these few blemishes there is much useful reading, and horticulturists are indebted to the authors for their kindly interest, which we hope to see continued, for it is the first attempt at anything like sound treatment of the subject. FRED. V. THEOBALD.

THE POSITION AND PROSPECTS OF CHEMICAL RESEARCH IN GREAT BRITAIN.[2]

The Status of Original Research.

TO all who are familiar with the influence of scientific progress on the evolution of civilisation, that is, to all students of the history of modern science, the general want of appreciation of research here cannot but be a matter of profound wonderment. It is not my intention to attempt an analysis of the causes of this public apathy on the present occasion. We must, I am afraid, deal with it as an accepted fact. Attention has from time to time been directed to this national weakness by the Press and by publicists whose influence should carry conviction to the lay mind. We can, no doubt, remember weighty utterances by statesmen such as the Duke of Devonshire, the late Lord Salisbury, Lord Rosebery, Mr. Chamberlain, Mr. Balfour, and, above all, in recent times, Mr. Haldane, who loses no opportunity of driving home the lesson of the importance of science and of scientific method to the national welfare. Nor have our scientific workers themselves failed to sound the note of alarm with all the authority of expert knowledge. But, in spite of these individual efforts, it cannot be said that we have made much headway; public interest in scientific research may still be considered to be on a low level—certainly lower here than in many other leading nations, and most decidedly lower than is desirable in the best interests of our country. A temporary flicker of excitement is caused when some sensational discovery is announced, or when some result of immediate practical (commercial) value is made known, but even in these cases the interest taken is only transitory and is narrowed down to the immediate issue; the broad cause which makes such results possible is lost sight of. The steady, plodding work which culminates in great discoveries is being carried on quite unheeded by the general public, and the workers themselves are practically unknown outside the ranks of science. Research as a "cult" is not understood; the national attitude towards the workers is one of "payment by results" in the very narrowest sense of the term.

How this state of affairs is to be remedied is a knotty question which I confess appears to me somewhat hopeless of solution at the present time. It may be that by persistent attack from within and the pressure of competition from without the country will, in fact must sooner or later, awaken to the situation. It may be that science will have to become more self-assertive and make its influence felt as a political power. There is need here, as has been often suggested, for a minister corresponding to the "Minister of Public Instruction," or the "Cultus-Minister" of other countries. The newly formed "British Science Guild" may fairly be expected in the course of time to help us in raising the level of public opinion towards the importance of research, this being, in fact, one of the primary objects for which this organisation has been founded.

The Jubilee of the Foundation of the Coal-tar Colour Industry and its Lessons.

The exaltation of scientific research into an abstract principle or "cult," which is the keynote of the remarks which I have put together for your consideration on this last opportunity when I shall have the honour of addressing you from the presidential chair, is, of course, a familiar subject to all who keep in view the objects of a society such as this. If I venture to formulate the principle somewhat more emphatically on this occasion, it is that the international gathering, which took place here last summer in honour of our distinguished past-president, Sir William Perkin, and in celebration of the jubilee of the foundation of the coal-tar colour industry, has given rise to many considerations which are intimately associated with the subject of this address. Although at that memorable assembly the voice of the nations was raised in gratitude for and in recognition of the numerous benefits arising from the establishment of a great industry, we must not forget that below the chorus of praise and congratulation, so justly sounded in honour of the founder, there was flowing an undercurrent of thought which, in some of the addresses and speeches, found verbal expression—the thought that this industry owed its existence to scientific research, and that it had been developed into its present magnitude by the never-ceasing applications of research. Speaking generally, it may be said that all the great steps, the new departures in the industry of coal-tar products, have been the outcome of pioneering work carried on in the first place without immediate reference to practical results. All honour to those who have developed these results into manufacturing operations, but honour in the first place to the scientific pioneers! This is the real lesson taught by the celebrations of last July. It may be of interest to consider in the next place how far this lesson has been learnt here on the one hand by the scientific public and on the other by the general public.

That the lesson has not been learnt by those who are most immediately concerned, the manufacturers themselves, is sufficiently apparent when we compare the enormous development of the industry in Germany with its comparatively small development here and its decadence in France, once an active centre and a successful competitor with us in the manufacture of coal-tar colouring

[1] "Sixth Report of the Woburn Experimental Fruit Farm." By the Duke of Bedford, K.G., and Spencer U. Pickering, F.R.S. Pp. v+235. (London: Eyre and Spottiswoode, 1906.) Price 4s.

[2] Abridged from the Presidential Address delivered at the annual general meeting of the Chemical Society on March 22 by Prof. Raphael Meldola, F.R.S.

matters. With respect to the public attitude, it may be said that such appreciation of Perkin's work as was expressed through our Press was just what might have been anticipated in a country where the true position of scientific research is imperfectly understood. The rejoicing was over the purely practical achievement—the discovery of the convertibility by chemical processes of so many otherwise useless tar products into saleable articles of commerce. The public cannot, as matters now exist in this country, go behind such proximate results. Moreover, the limitation of the appreciation in this way brings out very clearly the difficulties which must be encountered in any attempt to raise the status of scientific research in general, and of chemical research in particular, in the national estimation. Consider, by way of contrast, the works of the *littérateur* or artist; these appeal directly to the public or to some section of the public, and can be appreciated according to their merits. Not so the labours of the scientific investigator; his achievements are measured solely by the utilitarian standard; he is, as I said before, paid strictly by results. In other words, while literature and art have taken their position as "cults" in all civilised nations—a position to which they are fully entitled—science is judged by a lower and narrower standard, and certainly cannot be said to occupy in this country the same position as its sister branches of culture.

My contention is that scientific research, like every other branch of human culture, is worthy of national homage, whether it leads to immediately "practical" results or not—that its position in the scale of civilising agencies is not dependent upon such occasional stimulants as the jubilee of the foundation of a new industry or the announcement of a sensational discovery which furnishes materials for newspaper paragraphs. It would, I think, be generally admitted that any country which limited its appreciation of research to such branches of science as were likely to lead to industrial developments was on a low level in the scale of civilisation.

In maintaining the principle that scientific research has been, is being, and can always be carried on independently of its practical applications, I have no desire to give countenance to the view, somewhat prevalent, I fear, in this country, that there is some kind of antagonism between pure and applied science; that the scientifically trained chemist, for example, and the "practical" man, instead of being allies, as they should be, are in opposition. The days when such notions were held are, happily, passing away; if but slowly in this country much more rapidly abroad. My plea simply amounts to a claim for the re-adjustment of the positions of pure and applied science in the public estimation. The course of industrial development in the future is bound to become more and more interwoven with the development of pure science, and the perpetuation of erroneous ideas on this point cannot but act injuriously on both causes. In our own domain it is absurd to suppose that there is any antagonism between the two aspects of chemistry. Far from this being the case, it may safely be asserted from the experience furnished by the coal-tar industry that the rate of progress is actually measurable by the degree of substitution of pure science for empiricism. Those manufacturers who fail to recognise this principle do so at their own peril; those who have realised its truth cannot but admit that the more enlightened views respecting the function of science in the factory have been largely due to the influence of Perkin's work and example half a century ago.

Chemical Research in Educational and Manufacturing Centres.

I do not propose dealing in detail on this occasion with the very large question of the position of research in our universities, but, putting the case broadly, we should, I think, all agree that after making allowance for the few noteworthy exceptions, the actual contributions to our science from these centres are far below the standard, both of quality and quantity, which might be expected and which we should all like to see attained. If any doubt on this point should exist, it is only necessary to call to mind the productive activity in the Continental universities as compared with our own. Judged by this standard, there can be only one conclusion—that many of our universities are distinct failures as centres of chemical research, and that the total output of work from university laboratories is by no means worthy of the great traditions of this country as a pioneering nation in scientific discovery. If these seats of the highest learning, called into existence for the dissemination and promotion of knowledge, can give such a comparatively poor account of their achievements in chemistry, it is evident that there must be deterrent causes at work. It would be going beyond my province to attempt a detailed analysis of these causes here; they are numerous and not easy to deal with in a limited time, but some of them are of the same nature as those affecting the position of chemical research in other educational centres. They may be summed up under such headings as ancient traditions, defective educational methods, want of sufficient means leading to the frittering away of the research faculty by the drudgery of "coaching," the poor outlook for chemical research as a career, and the pedantic notion that a subject requiring for its advancement something akin to manual labour is derogatory to high scholarship. Behind these causes is the general public ignorance of and apathy towards research, to which I referred at the outset, and if I may paraphrase the utterances of recent authorities in the educational world, over them all is the trail of the examining board.

If we ask whether the modern educational development brought about by the technical education movement has fulfilled our expectations with respect to the advancement of chemical science, I for one must confess to a feeling of profound disappointment. There may be better times ahead when that era of public enlightenment dawns, but at present, with a few notable exceptions, these twenty-three London polytechnics are, on the whole, so little productive that we may discount them as active centres of research. It must be remembered, moreover, that this class of institution has spread all over the country, and that the total expenditure in the way of money and teaching energy is so great in comparison with the output of original work that chemists have every right to ask why this state of affairs should exist.

Turning now to the consideration of the causes of this failure on the part of the new educational establishments, I must, in the first place, guard myself against the imputation that I am disparaging their work. The most acute form of disappointment is that which is experienced when we find weakness where we had looked for strength, and in emphasising their weakness from our standpoint I am not shutting my eyes to their usefulness in other directions. It is not a depreciation of the work which they are doing if we deplore their failure in another branch of work which they might be doing. From what I know of these institutions, and from information furnished by very good authorities, I am satisfied that in some directions, and more especially in connection with engineering and trade subjects and handicrafts—in all of which the artisan is an important element—they are doing a certain amount of good to the various industries concerned. But the danger for us is the general tendency in this country to ram the whole scheme of education into one mould, utterly regardless of the fact that the requirements of, let us say, an engineer are quite different from those of a chemist. It is for this, among other reasons, that our subject has suffered both in its scientific and industrial aspects, because the time and energy of the teachers of chemistry in these institutions are so largely frittered away in what might be called inconsequential labour on behalf of a class of student quite unprepared by previous training for assimilating the principles of our science and for the most part unable to give sufficient time to the subject to acquire any real working knowledge of it.

There is another factor to be added to those which are acting detrimentally towards the cause of research in these institutions, and that is the want of sufficient endowment. I am afraid that it is characteristic of our countrymen to neglect the most important interests until they are forcibly awakened to their danger, and then to try and make up for past neglect by rushing precipitately into the first plausible scheme that is presented. There is no doubt that the new educational development suffered much at the outset from this characteristic mode of procedure. The wrong kind of person was often allowed to frame the

educational policy; the financial strength was exhausted in buildings and equipment, and the efficiency of the staff given only secondary consideration. We, of course, know that success in such educational work depends entirely upon the individual teacher—that the best mode of creating a school of chemistry, or any other subject, is to follow the advice of the late Sir William Flower with regard to the establishment of a museum: "First find a curator and let him build his museum around him." Had this principle been more generally adopted, the new institutions might by this time have been playing a really important part in the development of chemical science and chemical industry. As matters are, inadequate provision for maintenance having been made, the general standard of educational work is lowered in order that the grant-earning requirements of some examining board may be met, and as a result the establishments have to be run as purely business concerns.

There are other minor evils acting as retarding influences with respect to our subject and arising from the same cause, namely, the necessity of conducting these newer institutions, more or less, as commercial establishments. The prevalence of the "business" spirit among the committees and governing bodies gives an exaggerated importance to what may be called the office staff—the registrars and clerks. The work of the office staff is capable of being appreciated by the average committeeman, while the work of the scientific staff is generally beyond his comprehension, except so far as it can be measured by financial gain to the institution. It is not sufficiently realised that men of business and administrative ability are by no means rarities, while really good teachers of science are much scarcer, and men who combine both the qualifications of a good teacher with the inspiring zeal of an original investigator are rarest of all. Now if, as was professedly the case, the modern departure in technical education had for its object the improvement of the industries, then it is sufficiently well known to us here that the future of our subject is with the men of the latter class, and the joint exertions of all the registrars and clerks, backed by the efforts of the most skilful chemical pedagogues who get through their syllabus within the session and earn the largest grants or score the highest percentage of successful "passes," will never raise the level of this country either in chemical science or chemical industry.

It is sometimes stated that it was never contemplated that research should be carried on in these institutions—that this was the duty of the higher educational establishments. So it is the duty of the higher educational establishments, but the very fact that these are enabled to discharge their duty in a most imperfect way should have stimulated the newer institutions to make every effort to redeem our credit by making adequate provision for research. I will not venture to intrude my opinions concerning the vitalising influence of research upon other scientific subjects, but with regard to our own I have not the least hesitation in declaring the belief that a school of chemistry which is not also a centre of research is bound to degenerate and to become a mere cramming establishment not worth the cost of the maintenance. It is easy enough to follow the actual course of the degeneration process in such an institution. The teacher, who may be a man of real ability and who has entered with the hope of finding time and opportunities for research, finds himself, sooner or later, in the position of a chemical schoolmaster. The predominance of the business influence in the institution not only leads, as I have already indicated, to the lowering of the level of the instruction and to his own consequent degeneration, but he is, as a further consequence, so overweighted with business and administrative work that these, superadded to his teaching duties, leave him neither time nor energy for original work. The spirit of research within him is strangled by officialism, and his teaching faculties deadened by the monotonous toil of the annually recurring drudgery of routine teaching.

The scale of remuneration also does not enable these institutions to command the services of the best teachers, although I do not think that this is the chief deterrent cause, as there are numbers of young chemists of first-rate training and ability who would be quite willing to devote their time at the outset of their career to acquiring teaching experience in these establishments, even at some personal sacrifice, if facilities for research were given. In the present state of affairs one can only marvel at the fact that so many men of ability can be found willing to take service in these newer institutions, the more especially as, apart from the absurdly inadequate remuneration often given to the chiefs of the chemical departments, the payment of the subordinate members of the staff is generally on a scale which is nothing short of a scandal to the wealthiest of European nations. Considering the long course of training necessary to produce a competent teacher or demonstrator, and in view of the actual amount of work expected from these men who, by virtue of their attainments and position, are compelled to live up to a standard of high respectability, it seems almost incredible that the average scale of remuneration should not exceed the wages earned by an artisan, and is often below that standard.

According to the "Official List of Appointments" published by the Institute of Chemistry last year, there are on the staffs of the London and suburban polytechnics about fifty-four trained chemists. To these may be added 237 engaged in teaching in similar institutions in provincial centres throughout the United Kingdom. In one respect the hopes of those who expected great opportunities for chemists from the new departure in technical education have been realised. At the present time there are in this country in round numbers some 290 posts available for teachers of chemistry, which posts have actually been created by the latest movement in technical education. If now we ask whether the output of original work from these 130 centres is representative of the productive power of the 290 teachers, there can, I think, be only one answer, and that an emphatic negative. An examination of the lists of teachers in these centres shows that only about twelve out of the total number are carrying on research, and most of these in a desultory way. It is evident that there is justification for my complaint that there is this submergence of creative faculty going on all over the country; the nets have been spread and the capacity has been caught, but so far with comparatively little effect upon the development of new schools of chemical research.

The consideration of the question of the position of factories as centres of research is intimately bound up with the educational side of the subject, because we have to deal now with the educational establishments which are supplying the chemists for our factories. The feeders of the chemical factories are the universities and technical schools, British and foreign, and the question before us as the custodians of research is whether the absorption of the chemical talent from these sources by the factories is justified from the industrial point of view—whether these products of modern training, having entered into such careers, are being used to the best advantage. In other words, is that wastage of original faculty which, as I have endeavoured to show, is going on in the educational institutions, going on also in the factories? Whether the total number of chemists employed in our factories is what it should be is a point for the manufacturers themselves to consider. Even the extreme estimate of 1500 does not seem a very large chemical staff for the whole of the factories of Great Britain. In the German colour industry alone, according to information supplied to us seven years ago as jurors for the Paris International Exhibition, five of the great factories were employing 557 chemists—real scientific chemists, and not mere testing machines such as are dignified with the name of chemist in many of our factories.

From my own experience as head of the chemical department of a technical college, and with some knowledge of the requirements of chemical industry, I can state that the newer technical education, when conducted in the form of organised courses of day instruction extending over several years, has enabled us to capture a large amount of chemical capacity. Of the total output of trained chemists from the various institutions, a fair proportion—a number quite equal to the average in other countries—are possessed of the research faculty. We have seen what becomes of this when such men throw in their lot with the educational establishments. Are not we, the teachers, justified in asking whether the prospects of developing

this faculty in our factories are such as might be reasonably expected from the known requirements of chemical industry?

In answer to this question I am afraid we must come to the conclusion that here also there is an enormous submergence of research talent going on. It is true that the position is improving—that some of our more enlightened manufacturers have realised the value of such men, and by taking advantage of their faculties have improved their various industries. But these cases are as yet exceptional, and the ideal will never be reached until the research laboratory becomes a recognised and well-staffed department in every chemical factory. Do our factories possess departments which can honestly be described as centres of research in the sense, say, of the research laboratories of the German colour factories? I am afraid not; indeed, I know of scores of young men of great promise and ability who have been swallowed up by the factories and gradually degraded, in the chemical sense, into mere machines carrying out routine work which really required no elaborate chemical education for its effective performance. There is, of course, no satisfactory means of measuring the influence of the newer education upon the chemical industries of this country, and we can only speak from individual experience concerning the careers of our own students. It is upon this experience that I base the conclusion that our country is wasting its resources in a most reckless way so far as concerns the chemical industries. There is an enormous amount of talent available if our manufacturers would only utilise it in the right way. It has frequently been pointed out how, on the Continent and in America, the educational establishments and the industries are brought into relationship by the cooperation between the manufacturers and the teachers. Here, so far as chemical industry is concerned, such co-operation is practically unknown, and, as a consequence, there exists more or less distrust where there should be confidence, and both the educational and the industrial sides of our subject are crippled. This is perhaps the most powerful influence at work in this country in checking that development which follows normally from cooperation between the representatives of science and of industry.

Checks to the Wastage of the Research Faculty; Research Funds and Scholarships.

Turning now from the consideration of the various deterrent influences, we may in the next place deal with such counteracting agencies as are available in this country. It is clear, from our point of view, that any means by which the research faculty, having once been captured, can be given free scope for development, must be a distinct gain to our cause. All who have had to do with the training of chemical students must in the course of their experience have come across young men of exceptional talent as original workers. We are concerned more particularly with the utilisation of this faculty for the promotion of our science and with the maintenance of the principle that the submergence of this faculty means so much dead loss to the national resources. Now it unfortunately happens that many of the men thus gifted come from stations in life which render it imperative that they should proceed at once from the college to some bread-winning occupation. A few may perhaps be lucky enough to find appointments in which there is scope for the development of their faculties, but I am afraid the majority do not; they undergo that process of extinction as original workers which I have already dealt with. One of the most valuable counteracting agencies, and one the importance of which, from our standpoint, cannot be overestimated, is that system of awarding research scholarships to men of proved ability so as to enable them to carry on original work after finishing their college training. The value of this most rational method of endowing research is due mainly to the fact that the right men are captured in the right way; they are not, as it were, squirted promiscuously out of an examination mould, but they are selected by the teachers who have had them under observation during the whole course of their training and who know their real as distinguished from their examinational capabilities.

The other agency working against the stream of adverse influences is to be found in the various funds from which grants are made to individual workers for the prosecution of particular researches. There are three such funds available for the promotion of chemical research, the Government Grant Fund of the Royal Society, the grants distributed annually by the British Association, and the income derived from our own research fund. Of these, the two former have to be distributed over every branch of science, and chemistry takes its chance with other subjects. The total amount available for chemical research is not very large, and all who have served on the committees of any of these funds know very well that the amount applied for is generally much in excess of the sum available for distribution. The main difficulty of administration is, in fact, the equitable pruning of the various applications.

With regard to the results obtained through the research fund of this society, the present occasion is in every way opportune for directing attention to our achievements and to our needs. The income derived from this fund has hitherto enabled us to distribute annually a sum of about 220*l*.—a very modest amount considering the number of claims and the activity of our workers. Of the value of the assistance thus given we are, of course, all thoroughly aware here, but it may not be generally realised by the outer public what an enormous amount of good work is being promoted by the judicious administration of this very modest income. In order to get at the actual facts, our assistant secretary, Mr. Carr, has been so good as to prepare a table covering the eight years from 1898 to 1905 inclusive, and setting forth for each year the sum granted, the number of grantees, the total number of papers published by the grantees in our Journal or elsewhere, and other particulars which will be found in the table itself. From this it appears that 151 grantees during that period published 203 papers, thirteen failed to publish, ten have not yet published, and eighteen grants are still in the hands of the grantees. The total amount granted was 1770*l*., so that for this expenditure we have actually given to our science 203 papers, and more may be expected from those who still have grants in hand or who have not yet published their results. The figures as they stand, and even if nothing further is achieved, show that the grants average from 8*l*. to 9*l*. per paper, and, as we all know, each paper represents the results of at least one and frequently of several years' work. It is not going too far to say that there are no funds giving such substantial returns for so small an expenditure as these research funds, and their importance as aids to the advancement of knowledge cannot be overestimated.

With the additional capital by which our fund has been increased, the total income available for grants will be about 330*l*. per annum. In view of the demands upon that income it is obvious that even now we are possessed of but very limited means, and that the research fund committee will still be compelled, as has hitherto been the practice, to allot the grants for the purchase of materials or special apparatus. But, in addition to the promotion of research by the means indicated, there is another, and, according to my view, an equally valuable method, for assisting our workers in the prosecution of their researches, and that is the allotment of personal grants to enable the grantees to secure skilled assistance—to purchase, in fact, the services of human material as well as chemicals and apparatus. It is only want of sufficient income that has hitherto debarred the use of our fund in this way. I am so confident that an extension of our means towards this end would be productive of a most notable increase, both in the quantity and quality of the chemical research done in this country, that I have no hesitation in placing upon record the opinion that the next step taken in the forward policy of the Chemical Society ought to be in this direction. To do much good in the way of making personal grants we should, of course, require to capitalise a very large sum; we want an income of thousands instead of hundreds, and I confess that I see no immediate prospect of realising this dream. But there can be no doubt that for those who have the interests of our science at heart there could be no better method of subsidising research.

The general conclusion which appears to be justified

by this inquiry into the position and prospects of chemical research is, that the position here is by no means as satisfactory as we could wish—that much more might be done if the conditions were made more favourable for our active workers. In view of the actual achievements, accomplished in spite of the existing disabilities, it appears that the prospects for this country as a home of chemical research have been improving during the last decade with greater rapidity than at any previous period in the history of our society. But it is also obvious that there is much work yet ahead of us before the environment in which our workers find themselves is properly cleared from obstructions.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—A large and brilliant company assembled in the Sheldonian Theatre on Wednesday, June 26, to celebrate the Encænia. The recently elected Chancellor, Lord Curzon, presided. Reverting to a practice which has been discontinued for some years, the authorities reserved a portion of the upper gallery for undergraduates. Honorary degrees were conferred upon a number of men of distinguished eminence. The following is the text of the speeches delivered by Prof. Love in presenting the recipients of the degree of D.Sc. *honoris causa*. Dr. Ludwig Mond, F.R.S., upon whom the honorary degree of D.Sc. was to have been conferred, was unable to be present.

SIR RICHARD DOUGLAS POWELL, BART., K.C.V.O.

Humani generis defensor contra phthisim, pestem omnium tæterrimam, inventus est Ricardus Douglas Powell. Qui vir cum medicinæ se dedisset, ac præsertim huius morbi causas cognosceret, remedia excogitaret, curandi modos quos optimos esse iudicarat re probaret, summam gloriam et scientia et scriptis assecutus est. Difficile est pro meritis eum laudare qui nihil in vita egerit nisi ut laborantibus salutem afferat: illud brevissime dixerim hunc esse quo ne reges quidem nostri carere possint, seu adversa valetudine utantur, sive prospera. Fuit enim Reginæ Victoriæ nobis nuper ereptæ medicus ordinarius, et nunc Edwardo, regi nostro dilectissimo, medicus extra ordinem est. Viri merita declarat collegarum iudicium, a quibus Regalis Collegii Medicorum Præses factus est; declarant honores inusitati a rectoribus nostris collati, qui eum Baronettum et amplissimi ordinis Victoriani militem commendatorem creaverunt; declarant tacitæ tenuiorum gratiæ, quorum necessitatibus in maximis Londinii valetudinariis hic medicorum princeps ministrat.

SIR NORMAN LOCKYER, K.C.B., F.R.S.

Inter eos qui solis stellarumque natura quæ sit optime docuerunt primarium fere locum occupat Josephus Norman Lockyer. Dies me deficiat si miracula ab eo prolata de mundorum origine, de ratione quæ inter solis maculas et orbis terræ tempestates intercedat, si legationes solis defectus observandi causa in loca remotissima missas enumerare coner. Ex tot rebus gestis sumam duas tantum. Quadraginta abhinc annos duo viri, uterque suo Marte fretus, Jannssen in Gallia, in Britannia hic noster, instrumenta effinxerunt quibus usi flammas illas ingentes, quas e sole excurrere videmus quando eius orbi luna officit, sole non obscurato cernerent. Cum ex harum flammarum observatione multum de materia e qua sol constat colligi possit, res tanti habita est ab Academia Gallica ut numismate impresso insigniretur. Altera huius viri laus est singularis quod Acta Hebdomadalia, in quibus quicquid novi in omni Scientiæ Naturalis genere a viris doctis ubique repertum est enarratur, conscribenda curabit: qua in re cum summam diligentiam et peritiam præstaret, de omnibus qui scientiæ promovendæ student optime meritus est.

SIR WILLIAM RAMSAY, K.C.B., F.R.S.

In tenebris fere incognitis quæ inter Chemiæ et Physicæ fines intercedunt nemo certius insistit quam Willelmus Ramsay. Testis est illa Baronis Rayleigh vox in hac urbe tredecim abhinc annos audita, qui, cum vaporem incognitum quendam in aere esse confirmaret, hunc virum inventi socium esse dixit. Rariora posthac metallorum genera hic noster perscrutatus est, si qua huius vaporis vestigia deprehenderet; invenit autem non ipsum quidem vaporem sed metallum quoddam quod Helium vocant: hoc in sole exstare iam notum erat, nemo ulla eius apud nos indicia umquam odoratus est: mox cum de aeris natura subtilius quaereret, tres vapores novos detexit. His annis mirae eius metalli quod Radium appellatur virtutes et mutationes multorum animos commoverunt: hic vir exstitit qui stabile illud, quod ex his mutationibus gignitur, Helium esse ostenderet: quo facto causas quibus solis calor atque lumen per sæcula innumerabilia alitur illustrare potuit.

SIR WILLIAM HENRY PERKIN, F.R.S.

E conchis, radicibus, plantis, insectis antiqui pigmenta extrahebant, Willelmus Henricus Perkin inventus est qui ex carbonibus decoctis idem faceret, tanto successu ut hodie vel plantis vel animalibus supersederi fere possit. Quid? Nitidissimi calores quibus fulgent tot formosæ, quæ circumsedunt, dominæ, Doctorumque nostrorum vestes, quæ avium silvas Indicas incolentium plumas æmulantur, unde, quæso, hic splendor omnis profectus est nisi ex invento quod hic noster fecit, cum puer esset annos septendecim natus? Multi sunt, ut hunc omittam, qui ex hoc reperto divitias comparaverint, in Germania præsertim, ubi mercatores ita doctrina instituti sint ut inventa in usum convertere possint, et ea sit vectigalium ratio ut artificia nova pecuniis publicis adiuventur. Inventor ipse satis iam locupletatus se scientiæ totum dedit: lucis quidem repercussæ et ex alia re in aliam conversæ rationem et vim occultam nemo magis intellegit.

PROF. WATSON CHEYNE, C.B., F.R.S.

Rationum Listerianarum, ut cum chirurgis loquar, quasi personam gerit Willelmus Watson Cheyne, qui et in his constituendis inventoris socius fuerit et in exercendis multo longius progressus sit. Rebus in Africa Australi turbatis hic ad bellum profectus est civilis chirurgus cuius ope et cura milites uterentur. Dolendum est eius peritiæ tantum tum patuisse campum, medendi rationibus tantum fuisse opus: illud profecto gaudendum, hunc virum præsto fuisse qui sauciorum cruciatus leniret, quique chirurgiæ ratione usuque omni instructus multorum vitam conservare posset: nullo quidem in bello antea gesto tot e vulneratis redire potuisse notum est. Hodie pace confirmata chirurgiæ rationes optimas exponit, dumque multitudinibus in magnas urbes congregatis succurrit, diligentiam peritiamque suam difficillimo belli tempore probatam vir strenuus præstat.

MANCHESTER.—At the annual degree ceremony on June 29 the honorary degrees were conferred upon Baron D. Kikuchi and Prof. G. E. Hale, the presentation addresses being delivered by Prof. A. Schuster, F.R.S. Baron Kikuchi worthily upholds the spirit of open-minded fraternity which unites the universities of the world. A graduate of Cambridge, he has occupied the chair of mathematics in the Imperial University of Tokyo, and through his studies of the older mathematicians of Japan he has taught us interesting facts as to their methods of investigation. He has held the position of president of the Imperial University, and of Minister of Education; he has represented his country at important international conferences, and taken an active part in introducing a scientific system of weights and measures into Japan. Prof. G. E. Hale was formerly director of the famous observatory of the University of Chicago, built and equipped by the late Mr. Yerkes, and is the organiser and director of the Mount Wilson Solar Observatory, on the crest of the Sierra Nevada.

It is of interest to note that the M.Sc. degree was conferred upon the exceptionally large number of sixty-three candidates. Under the new regulations, the master's degree in science is only obtainable upon satisfactory completion of post-graduate study or research, and there is thus every indication of the success of the scheme in increasing the spirit of research in the University.

MR. J. STRUTHERS, lecturer in agriculture and chemistry in the West of Scotland Agricultural College, Glasgow, has been appointed secretary and agricultural chemist in Japan to the Asociación Salitrera, and leaves in August to take up his new duties in Tokyo.

THE offer of nomination for appointment by the Crown on the governing body of the Imperial College of Science and Technology has been accepted by the Earl of Crewe, Lord President of the Council; Mr. Gerald W. Balfour; Sir Francis Mowatt, G.C.B.; Sir Julius C. Wernher, Bart.; Sir William H. White, K.C.B., F.R.S.; and Dr. MacAlister, principal of the University of Glasgow. The other persons nominated as first members of the governing body are:—by the President of the Board of Education, Mr. A. H. D. Acland; Mr. F. G. Ogilvie, C.B., a principal assistant secretary of the Board of Education; Mr. J. C. G. Sykes, an assistant secretary of the Board; and Dr. R. T. Glazebrook, F.R.S., director of the National Physical Laboratory; by the University of London, Sir E. H. Busk, past Vice-Chancellor of the University; Prof. Capper; Prof. Farmer, F.R.S.; Sir Henry E. Roscoe, F.R.S.; and Sir A. W. Rücker, principal of the University; by the London County Council, Mr. A. A. Allen, M.P.; Mr. H. Percy Harris, chairman of the Council; Sir C. Kinloch-Cooke; Mr. R. A. Robinson; and Mr. J. T. Taylor; by the City and Guilds of London Institute, the Earl of Halsbury, F.R.S., chairman of the council of the institute; Sir J. Wolfe Barry, K.C.B., F.R.S.; Sir Owen Roberts, clerk to the Clothworkers' Company; Sir Walter S. Prideaux, clerk to the Goldsmiths' Company; and Sir John Watney, hon. sec. of the institute; by the Royal Commissioners for the Exhibition of 1851, Viscount Esher, G.C.V.O., K.C.B., and Lieut.-Colonel Sir Arthur Bigge, G.C.V.O., K.C.B.; by the Royal Society, Sir Archibald Geikie, F.R.S.; by the professorial staff, Prof. Tilden, F.R.S., Prof. Gowland, and Prof. Dalby; by the Institution of Civil Engineers, Sir Alex. B. W. Kennedy, F.R.S., president of the institution; by the Institution of Mechanical Engineers, Mr. T. Hurry Riches, president of the institution; by the Institution of Electrical Engineers, Mr. R. Kaye Gray, past-president of the institution; by the Iron and Steel Institute, Sir Hugh Bell, Bart., president of the institute; by the Institution of Naval Architects, Dr. F. Elgar, F.R.S.; by the Society of Chemical Industry, Dr. E. Divers, F.R.S., past-president of the society; by the Institution of Mining Engineers, Mr. A. Sopwith, past-president of the Institution; and by the Institution of Mining and Metallurgy, Mr. W. McDermott, past-president of the institution. The draft charter for the establishment of the college will be submitted to His Majesty for approval at the council fixed for July 6.

THE Board of Education has published (Cd. 3538) a summary of figures relating to State-aided secondary schools in England. The number of schools dealt with in the summary is 600, but in addition to these there are ninety-three secondary schools provisionally recognised by the Board or seeking recognition, though these are not included. The total number of scholars, excluding pupil teachers, in the 600 schools is 104,938. About 80 per cent. of the total number of scholars are fifteen years of age or under, and the remaining 20 per cent. represent the number of pupils in State-aided secondary schools more than fifteen years of age. About a quarter of the total number of pupils in these secondary schools previously attended public elementary schools and are paying no fees in the secondary schools, while 54 per cent. of the total number previously attended public elementary schools. It is important to remember that the curriculum of secondary schools receiving grants from the Board of Education is dominated by a four years' course of work designed for children who will remain at school until they have completed their sixteenth year at least, and that no grants are paid for pupils under twelve years of age—nearly a quarter of the above total—nor for those who have completed the approved course. There seems, in fact, to be little relation between the character of the prescribed course and the special needs of the majority of the children. If 80 per cent. of the pupils finish their school life at fifteen or under, the curriculum might with advantage be modified in such a way that thoroughness and completeness in a few fundamental subjects may be secured by the majority of the pupils rather than to allow them to fritter away their few valuable years in beginning a course of work which is doomed to be left unfinished and from which little advantage can be gained.

NUMEROUS handsome bequests have been reported in *Science* during the last three months, and in addition to specially large gifts there has been a continuous record of munificence as represented by sums which are small only when judged by American standards. Among other large amounts, the following deserve special mention:—Creighton University has received 500,000*l.* under the will of the late Mr. J. A. Creighton; Teachers College, Columbia University, has been presented with 80,000*l.* by an anonymous donor, and 60,000*l.* under the will of the late Mr. F. P. Furnald. The State Legislature has provided the University of Alabama with 80,000*l.* for buildings and 5000*l.* a year for maintenance. Dartmouth College benefits to the extent of 50,000*l.* under the will of the late Captain Thomas P. Salter. The University of Chicago has received land from Mr. J. B. Rockefeller worth more than 500,000*l.* The Princeton University has received anonymously a gift of 240,000*l.*

DR. J. C. MCLENNAN, for some years director of the physical laboratory in the University of Toronto, has been elected to the professorship of physics in succession to Dr. James Loudon.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, May 23.—"The Relation of Thallium to the Alkali Metals: a Study of Thallium Sulphate and Selenate." By Dr. A. E. H. **Tutton**, F.R.S.

The author finds that the crystals of thallium sulphate and selenate resemble those of the analogous salts of potassium, rubidium, cæsium, and ammonium adequately closely morphologically to enable them to be classed in the same orthorhombic isomorphous series, the average difference of corresponding interfacial angles on analogous potassium and thallium salts being less than half a degree, and the maximum difference only just exceeding a degree. These differences, however, though small, are greater than those between any other of the salts, the average difference, irrespective of direction, being proportional to the higher atomic weight of thallium.

The law revealed by the author's former work, that the changes in the interfacial angles are progressive functions of the atomic weights of the interchanged metals, only applies, however, to potassium, rubidium, and cæsium, which belong strictly to the same family group of the periodic classification of the elements; for the differences in the case of thallium occur in either direction indifferently.

The molecular volumes and topic axial ratios (separation along axial directions of centres of contiguous molecules) are almost identical with those of analogous rubidium and ammonium salts, so that structurally thallium comes alongside rubidium and ammonium, intermediate between potassium and cæsium.

Optically, however, the thallium salts are quite different, the refractive indices, molecular refractions, and dispersion being far higher, indicating the essential chemical difference of thallium from the true alkali metals and ammonium.

Entomological Society, June 5.—Mr. C. O. Waterhouse, president, in the chair.—*Leioptilus carphodactylus* in Britain: Dr. T. A. **Chapman**. A living example; one of the first bred British specimens.—*Microdon mutabilis* and *Kleditoma myrmecophila*: H. St. J. **Donisthorpe**. A specimen of *Microdon mutabilis*, with the empty pupa-case, bred from a larva taken in the nest of *Formica fusca* at Porlock, April, 1907; also ♂♂ and ♀♀ of *Kleditoma myrmecophila*, n.sp., bred last month from a nest of *Lasius fuliginosus* found at Wellington College in March.—New Phytophaga from Australia: M. **Jacoby**. Examples of small beetles, new to science, of the new genus Clythridæ (Phytophaga), including *Leasia australis*, Jac.—Types of Proctotrupidæ: A. J. **Chitty**. The three types of the three species of Proctotrupidæ described by Westwood, but entirely overlooked by subsequent authors.—A parasitic South African fly: E. E. **Austen**. Examples of *Cordyloba anthropophaga*, Grunb., an African fly, parasitic in the larval stage on human beings and animals—a true Muscid—hitherto confused with another fly. The author exhibited *Bengalia depressa*, Walk., a totally different

insect.—The significance of some secondary sexual characters in butterflies: Prof. E. B. **Poulton.**—Report of entomological observations made in South Africa during the visit of the British Association in 1905: Dr. F. A. **Dixey** and Dr. G. B. **Longstaff.**

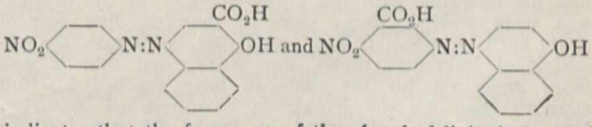
Linnean Society, June 6.—Prof. W. A. Herdman, F.R.S., president, in the chair.—Contributions to our knowledge of New Zealand Holothurians: Prof. **Dendy** and E. **Hindle.**—Report on the marine fishes collected by Mr. Stanley Gardiner in the Indian Ocean: C. Tate **Regan.** The collection contained examples of nearly 200 species, more than fifty of which were new to science, among them some remarkable new generic types. A large proportion of the new species were dredged at considerable depths, and the others chiefly belonged to genera the species of which have been supposed to be more variable and more widely distributed than proves to be the case.—The Ixodidæ collected in the above expedition: Prof. **Neumann.**

Physical Society, June 14.—Mr. H. M. Elder, vice-president, in the chair.—The electric arc: Mr. **Upson.** Arcs were described in which the electrodes consisted of carbon, copper, iron, and aluminium in different combinations, maintained in air, hydrogen, and coal-gas. With 110 volts supply, metal arcs in hydrogen took the form of a spark discharge. At that voltage the maximum length of arc it was possible to obtain, with current up to 15 amperes, was 0″·05, except where both electrodes were of the same metal. When carbon is one of the electrodes a true arc is formed. If carbon is negative the maximum length of arc with the above voltage is 0″·07. Volt-ampere characteristic curves were shown for arcs in air and hydrogen of length 0″·05. The general position of the curve is determined by the material of the negative electrode. With carbon negative, in hydrogen, the curves for various positive electrodes very nearly coincide. With carbon positive, they keep the same curvature, but vary in distance apart, according to the material of the negative. In general, the position of the curve is governed by the negative, but its particular shape seems to come from the influence of the surrounding gas.—The Poulsen arc as a means of obtaining continuous electrical oscillations: Dr. J. A. **Fleming.** Dr. Fleming showed and described an apparatus for forming an electric arc in an atmosphere of coal-gas between a carbon rod kept in slow rotation and a cooled copper anode, the arc being formed in a magnetic field of 600 to 1000 C.G.S. units. The arc was supplied with continuous current at a pressure of 400–500 volts. A condenser of 0·003 mfd. capacity in series with an inductance of 200,000 cm. was shunted across the arc, and experiments shown to prove the existence of high-frequency oscillations in the condenser circuit. A long resonance helix of insulated wire was then joined to the condenser circuit, and when tuned to it created a powerful high-frequency field round it in which vacuum tubes glowed brilliantly. By vibrating or rotating a neon vacuum-tube of spectrum type near the helix, and showing that the band or disc of light was cut up by dark spaces, Dr. Fleming supported the contention that the oscillations so produced are not absolutely uninterrupted, but cut up into groups.—A direct-reading conductivity bridge for testing rods of steel or other material, where there is considerable range of conductivity between successive specimens, and where it is necessary to eliminate the resistance of end contacts: R. **Appleyard.**

Chemical Society, June 20.—Sir William Ramsay, K.C.B., F.R.S., president, in the chair.—Some properties of radium emanation: A. T. **Cameron** and Sir W. **Ramsay,** K.C.B. It has been discovered that the emanation from radium undergoes a rapid change of volume shortly after its change from the solid to the gaseous state; this is followed by a slow change corresponding with its loss of electrical activity. It has been shown by thirty sets of measurements that the emanation behaves in accordance with Boyle's law, both before and after this preliminary change. Measurements have been made of the initial volume of the emanation obtained from a solution of 87·7 milligrams of radium (metal) as bromide and sulphate. From these it would appear that, instead of the previously accepted value for the average life period of radium, 1100 years, a much shorter life must be deduced, namely, 236 years.—The affinity constants of amino-sulphonic acids as determined by the aid of methyl-orange: V. H. **Veley.** The affinity constants of the aminonaphthol-sulphonic acids when determined by the tintometer method show, as regards the effect of the introduction of the hydroxyl grouping in the naphthylaminesulphonic acids, relationships similar to those observed by Ostwald by the electric conductivity method for the hydroxybenzoic acids as compared with benzoic acid. One possible case of steric hindrance induced by the introduction of the hydroxyl grouping in the 8-position was noted.—Azo-derivatives of 1 : 3-diphenylbarbituric acid. Dynamic isomerism among the coloured hydrazones of 1 : 3-diphenylalloxan: Miss M. A. **Whiteley.** In order to throw some light on the structure of the compounds obtained by the action of aromatic diazonium chlorides on the 5-alkyl-substituted derivatives of 1 : 3-diphenylbarbituric acid, the investigation has been extended, and the action of the β-substituted derivatives of phenylhydrazine on 5 : 5-dibromo-1 : 3-diphenylbarbituric acid has been examined. The results show that the yellow compounds obtained in the first reaction are azo-derivatives, whilst the red ones obtained in the second are hydrazones.—A series of coloured diazo-salts derived from benzoyl-1 : 4-naphthylenediamine: G. T. **Morgan** and W. O. **Wootton.** The examination of the diazo-salts of benzoyl-*p*-phenylenediamine and benzoyl-1 : 4-naphthylenediamine has been continued, and it has been found that the diazo-derivatives of the latter base are extremely stable substances which are invariably coloured. These coloured salts might be regarded either as *syn*-diazo-derivatives or as equilibrium mixtures of diazonium and *syn*-diazo-derivatives, although their great stability somewhat militates against the assumption that they consist wholly or in part of *syn*-diazo-compounds.—Colour and constitution of azo-compounds, part i.: J. T. **Hewitt** and H. V. **Mitchell.** The authors recently directed attention to the very marked change in colour when *p*-nitro-derivatives of arylazo-*p*-phenols were dissolved in alkalis. The explanation was offered that, whilst benzeneazophenol forms alkaline salts of corresponding constitution, the *p*-nitro-derivatives furnish salts with the metal attached to the nitro group, and therefore diquinonoid in structure. The relationships are rendered apparent by the formulæ

$C_6H_5.N:N.C_6H_4.OK$ and $KO_2N:C_6H_4:N.N:C_6H_4:O$.

Comparison of the two carboxylic acids



indicates that the frequency of the absorbed light is lowered by increase in the length of the chain of alternate single and double linkings. The introduction of substituents may modify the length of the chain owing to the possibility of more stable salt formation in other directions.—The oxidation of hydrazines by free oxygen: F. D. **Chattaway.**—Calmatambin: a new glucoside: F. L. **Pyman.** This glucoside from the bark of a West African tree, probably *Canthium glabrifolium*, has the formula $C_{19}H_{28}O_{13},2H_2O$, contains one methoxyl group, and is readily hydrolysed by dilute acids and by emulsin forming calmatambetin, $C_{13}H_{18}O_8,\frac{1}{2}H_2O$, together with dextrose. The former is readily decomposed by the action of dilute acids, and yields a small amount of a scarlet, crystalline substance, $C_{11}H_{12}O_3$.—The decomposition of hyponitrous acid in presence of mineral acids: P. C. **Rây** and A. C. **Gangúli.** Hyponitrous acid when liberated from silver or mercurous hyponitrite by the action of dilute nitric, hydrochloric, or sulphuric acid at 25° decomposes at once according to the equations (1) $2HNO=H_2O+N_2O$, (2) $5HNO=2H_2O+HNO_3+4N$.—The chemical composition of petroleum from Borneo: H. O. **Jones** and H. A. **Wootton.** The petroleum from Borneo consists of approximately equal quantities of homologous hydrocarbons of the paraffin, *cyclo*-hexane, and aromatic series, and contains the members of the naphthalene series to the extent of about 6 per cent. to 7 per cent.—The synthesis of pheno-

naphthacridines: trimethylphenonaphthacridines: A. **Senier** and P. C. **Austin.**—The condensation of aldehydes with mixtures of α-naphthol and α-naphthylamine: synthesis of

$$\begin{matrix} \alpha\text{—N—}\alpha \\ \text{7-aryl-} \quad | \quad \text{-dinaphthacridines} \\ \beta\text{—CH—}\beta \end{matrix}$$

: A. **Senier** and P. C. **Austin.**—An improved form of apparatus for the rapid estimation of sulphates and salts of barium: W. R. **Lang** and T. B. **Allen.** The authors have simplified the apparatus of Tarugi and Bianchi for the estimation of sulphates and salts of barium by a volumetric method based on the rapid clearing of turbid solutions in tubes of narrow calibre.—The determination of sugar by Fehling's solution: W. R. **Lang** and T. B. **Allen.** The apparatus described by the authors (preceding paper) was also employed for the determination of dextrose by means of Fehling's solution.—Studies in asymmetric synthesis, vi., the asymmetric synthesis of the optically active tartaric acids: A. **McKenzie** and H. **Wren.** The asymmetric synthesis of *l*-tartaric acid was accomplished in three ways:—(1) by the oxidation of *l*-bornyl fumarate in glacial acetic acid solution by potassium permanganate; (2) by the oxidation of the potassium salt of *l*-bornyl hydrogen fumarate in aqueous solution by potassium permanganate; (3) by the oxidation of *l*-menthyl fumarate in an analogous manner. The asymmetric synthesis of *d*-tartaric acid was accomplished by the oxidation of the potassium salt of *d*-bornyl hydrogen fumarate.—Some derivatives of 2-phenyl-1:3-naphthylenediamine, part i.: N. **Lees** and J. F. **Thorpe.** Typical derivatives of the base have been prepared and investigated, and the conditions have also been determined under which it is converted into the corresponding dinaphthol and the two amino-naphthols.

EDINBURGH.

Royal Society, May 6.—Dr. Robert Munro in the chair.—Inbreeding in the Barbary sheep and in the common goat: Prof. J. C. **Ewart,** F.R.S. The herd of Barbary sheep, which had been living for about a century at Abercairney, in Perthshire, seemed to be as vigorous and prolific now as when they were first introduced, and yet there had been no fresh blood added for at least fifty years. The problem was, why should this vigour continue in spite of inbreeding? To answer this question a series of experiments had been begun in 1899 with a pair of common goats. The great-great-grandson in 1905 was as vigorous as the original male, whom he closely resembled, and his offspring with the grand-daughter of the original pair were decidedly more vigorous than the first pair of goats born in 1900. It was found that, as a rule, the offspring of immature males was weak, and that it was more important for the male to have reached his full strength than for the female to have reached maturity. One reason why inbreeding in herds did not lead to deterioration seemed to be that the weaklings were eliminated, and every now and again there was a restoration of a vigorous ancestor.—Report on fossil fishes collected by the Geological Survey in the Lower Carboniferous rocks near Gullane, East Lothian: Dr. R. H. **Traquair,** F.R.S. The list contained thirteen species, of which two were new. A comparison with the fossils of other similar shales showed that the Gullane rocks corresponded most closely with the Wardie shales, there being eight of the thirteen species in common.—Heusler's magnetic alloy: Alexander D. **Ross.** The particular alloy experimented with had a composition of manganese 25 per cent., aluminium 12·5 per cent., a trace of lead, and the remainder copper. The aim of the research was to find how the magnetic susceptibility varied under various thermal treatment, such as heating up to different high temperatures, cooling down to the temperature of liquid air, and bringing back the alloy to its original state either suddenly or gradually. When quenched at 610° C., the material showed distinct diminution in permeability, which was not so marked when the quenching was from either higher or lower temperatures. This was perhaps the most interesting among a number of other results obtained.—The physical properties of mixed solutions of independent optically active substances: Clerk **Rankin** and Dr. W. W. **Taylor.** The properties chosen for measurement were the viscosity, the density, and the electric conductivity. The optically active substances were the normal potassium tartrates and the tartar emetics, and, for the sake of comparison, potassium racemate and racemic emetic. The independent optically active substance was cane sugar, and in one set of experiments maltose. Equivalent solutions of the three *d*, *l*, and *r* substances were made, and the physical properties determined at 15° C. and 25° C. A definite weight of sugar was then added, and the measurements again made. The general conclusion was that the addition of an independent optically active substance to solutions containing optically active stereoisomers does not cause any recognisable differences.

May 20.—Dr. Traquair, vice-president, in the chair.—A new method of ascertaining twist in single threads: Thomas **Oliver.** The usual microscopic method in the case of combed yarns is fairly accurate, but is very unsatisfactory in the case of carded woollen threads. The new method depended on the relation formerly obtained by the author between the "take-up" and the turns per inch in the twisted thread, and consisted in determining the number of turns required to give the maximum length as the thread was untwisted.—The influence of twist on the strength of a thread: Thomas **Oliver.** Under tensile stress the elongation of a thread is not quite proportional to the stress. With increasing stress the increment of elongation increases. At length a certain point is reached when the increment of length for a given increment of stress becomes distinctly greater, and goes on increasing to the breaking point. This yield point was chosen as an indication of the strength, and thus it was possible to compare the strengths of the thread in different conditions of twist without breaking it. The relation between the strength y and the number of turns of twist per inch x could be represented by the equation $y = bx^2/(x^2 + b^2/k)$, where b and k are constants for each thread. The paper contained a critical examination of a formula given in 1879 by Prof. Hartig, and of some conclusions advanced by Profs. Hübner and Pope in a paper on the influence of certain reagents on the tensile strength of cotton yarn.—Notes on some oligochætes found on the Scottish Loch Survey, and also on some Turbellaria from Scottish lochs: C. H. **Martin.** The notes were chiefly concerned with the genital organs, and one new species of oligochæte worms was described. An interesting point was noted in connection with the Turbellaria. This worm feeds on the Hydra. The nematocysts are not digested, but, retaining their vitality, work out to the external skin, finally assuming the position normally occupied in the Hydra.—The composition of red clay: Dr. F. W. **Clarke.** Fifty-one specimens of red clay from various localities had been supplied by Sir John Murray. These were combined in equal weights, and the composite sample so obtained carefully analysed. In most respects the analysis agreed fairly well with the average of the original *Challenger* analyses, but showed distinctly less iron and a small quantity of a number of minor elements not hitherto reported, such as titanium, barium, strontium, vanadium, &c.—The glaciation of east Lothian, south of the Garlton Hills: Prof. **Kendall** and E. R. **Baily.** This paper gave a detailed account of the glaciation of the district described, the positions and manner of formation of the various glacial lakes and their outflows being indicated as the ice advanced and retreated. Some interesting illustrations were given of the way in which a tributary falling into a flat valley formed an accumulation of detritus which finally turned back the course of the upper tributaries into another channel and quite altered the watershed. The view which explains certain so-called raised beaches as the result of glaciation was also emphasised. The evidence of the old lake basins and of the Boulder-clay deposits led to the same conclusions.

June 3.—Prof. Crum Brown, F.R.S., in the chair.—Temperature changes occurring in fresh-water lochs: E. M. **Wedderburn.** There were three types of temperature distribution occurring in the Scottish lochs. From December to March the temperature was practically uniform throughout; from April to July the heating of the surface waters led to a distribution in which the gradient of temperature with depth was at no place very rapid, but from August to November a "discontinuity

temperature layer" came into existence, the so-called *Sprungschicht* of the Austrian and German naturalists. Down to the depth of this discontinuity layer the temperature varied very slowly, and below it, down to the bottom of the loch, there was an almost constant temperature, but within the layer the temperature varied very rapidly. This the author believed to be due to the action of the winds blowing over the surface and separating out the two great masses of water of different temperature and density. The explanation was illustrated experimentally by means of a trough containing a layer of salt water with a layer of fresh water above it. A blast of varying strength could be blown along the surface, causing the fresh water to heap up towards the leeward end, and producing a back current along the bottom of the fresh-water layer. This back current drew the upper layer of the salt water after it, and set up a feeble return current in the salt-water layer in the same direction as the original current on the surface due to the wind. When the blast ceased a seich-like movement was produced in the salt-water layer, exactly similar to the temperature seiche which had been observed in the Scottish lochs.—A specimen of *Helix pomatia* with paired male organs: Dr. J. H. **Ashworth.** In addition to the normal set of reproductive organs present on the right side, this specimen possessed on the left side a set of accessory male organs. The normal and supplementary male organs were equally developed and were symmetrically placed, and the supernumerary genital aperture occupied a position on the left side exactly corresponding to that of the normal aperture on the right side. The form of the supplementary organ supports the view that the present position of the genital ducts in Helix and other Stylommatophora has been derived from a condition existing in the ancestral form in which the vas deferens and penis were connected with the primitive genital aperture by means of a lateral groove, such as still exists in Pythia.—Encystment of Tardigrada: James **Murray.** This remarkable transformation began with the forming of a cyst under the original skin of the mature animal, the skin gradually shrivelling, the feet disappearing, and the creature reverting to an embryonic state with loss of all its principal organs. After a period of rest the organs develop again, and the animal finally emerges from its case exactly as it was before the encystment began.

PARIS.

Academy of Sciences, June 24.—M. Henri Becquerel in the chair.—A new mineral species from the high temperature fumerolles of the recent eruption of Vesuvius: A. **Lacroix.** The mineral has the composition

$$PbSO_4.(K \text{ or } Na)_2SO_4,$$

and the name palmierite is proposed for it.—A new method of preparing anhydrous oxide of lithium: M. **de Forcrand.** Pure lithium carbonate is heated to a temperature of 780° C. to 800° C. in a platinum boat in a current of dry hydrogen. In about three hours the whole of the carbon dioxide is eliminated, and pure Li_2O remains. The heat of solution of pure lithium monoxide, prepared in three different ways, was found to be 31·2 calories, or more than five calories higher than the previously accepted number of M. Beketoff.—The addition of water to ethylenic oxides by means of sulphuric acid: Louis **Henry.** Now that an application of Grignard's reaction gives a means of preparing ethylene oxides in a general manner, the author has studied the mode of hydrolysis by dilute acids, and gives a series of glycols, with their boiling points, which have been prepared.—The secretary announced the death of Charles Trepied, correspondant for the section of astronomy, and A. Crova, correspondant in the section of physics.—Observations of the comets *c* and *d*, 1907, made at the Observatory of Algiers: MM. **Rambaud** and **Sy.** Observations were made on eight nights between June 5 and 19. The positions of the comparison stars and the apparent positions of the comet are given.—A species of analytical geometry of systems of additive functions: Frédéric **Riesz.**—The functional equation of M. Fredholm: A. **Korn.**—Ensembles of functions and linear operations: Maurice **Fréchet.**—The secondary kathodic emission of metals under the influence of the α-rays: Marcel **Moulin.** The existence of a secondary radiation of the α-rays, at first generally admitted, has been called in doubt by several recent workers. Preliminary experiments in favour of the hypothesis of the existence of such secondary radiations are given.—Drops formed in a magnetic field: H. **Ollivier** and Pierre **Sève.**—Thermochemical data relating to the ammoniomercuric base and its hydrates: H. **Gaudechon.** The immediate solution effected by a solution of potassium cyanide is utilised as a means of carrying out the thermochemical measurements. The data used as a basis for the calculations are indicated in full.—The nature of sulphammonium: P. **Lebeau** and P. **Damoiseau.** A repetition of the work of Henri Moissan and of Otto Ruff and Geisel. The latter indicate a reversible reaction between sulphur and ammonia, giving rise to nitrogen sulphide and ammonium sulphide. In the present paper it is shown that if minute precautions are taken to ensure the complete absence of moisture, neither nitrogen sulphide nor ammonium sulphide is formed. The weight of sulphur recovered after evaporation of the liquid ammonia is exactly the original weight, and no trace of sulphuretted hydrogen is given off during the evaporation.—The combinations between silicon and molybdenum. Molybdenum bisilicide: Ed. **Defacqz.**—The various molecular states of anhydrous ferric sulphate and hydrated ferric sulphate: A. **Recoura.**—Cuprous iodide: Marcel **Guichard.** All attempts to prepare cupric iodide by working at low temperatures failed. Hydriodic acid, liquefied at a low temperature on cupric chloride, gives rise at once to a mixture of cuprous iodide and free iodine. The iodine appears at the commencement of the reaction, and is easily separated either by solution or sublimation. A new method of analysis of iodides is given.—A study of the alloys of cobalt and tin: F. **Ducelliez.** The method of isolation and the properties of the alloy CoSn are described.—A molybdo-uranic combination: André **Lancien.** The precipitate formed by the interaction of ammonium molybdate and uranyl nitrate has the composition of uranyl molybdate, UO_2MoO_4.—Lupeol: E. **Jungfleisch** and H. **Leroux.** A comparison of the properties of the alcohol lupeol, isolated from different samples of gutta-percha.—The action of some esters of the α-iodo-fatty acids on the iodide of magnesium phenylamine and magnesium orthotoluidine iodide: F. **Bodroux** and F. **Taboury.**—The origin of the deposits of colouring matter in red wines: A. **Trillat.** The deposit is caused by the formation of an insoluble compound of the red colouring matter with acetaldehyde. In the absence of the aldehyde the red substance is not affected by the oxygen of the air.—The synthesis of an aldehyde possessing the odour of violets, cyclo-lemonylidene-propenol: Ph. **Barbier.** Lemonal and propionic aldehyde are condensed by dilute soda in weak alcoholic solution. The resulting aldehyde is treated with 60 per cent. sulphuric acid. Two aldehydes result, both possessing an intense odour of fresh violets, and superior to that of ionone. These have the drawback of oxidising very rapidly by exposure to air, and losing their smell in consequence.—The phenomena of coloration of brown bread: Gabriel **Bertrand** and W. **Mutermilch.**—Observations on the primordial leaves of various species of the genus Achillea: Léon **Dufour.**—The fungus-cultivating ants of Madagascar: H. **Jumelle** and H. Perrier **de la Bathe.**—Some variations observed in the rose: Lucien **Daniel.**—The morphological value of the spines of coral: Louis **Roule.**—The persistence of the trocophore in a Hesionian: C. **Viguier.**—Some new ideas on the white bearded gibbon, *Hylobates leucogenys*: Louis **Boutan.**—A general table of the encephalic weights as a function of the body weight: Louis **Lapicque.**—The association of unicellular algæ with *Sarcophytum mycetoides*: Ch. **Gravier.**—The measurement of the pulmonary field and its activity: Gabriel **Arthaud.**—The physiological action of some colouring matters and their urinary excretion: Jean **Gautrelet** and Henri **Gravellat.**—The relation between oceanic whirlpools and volcanoes: E. A. **Martel.**

NEW SOUTH WALES.

Linnean Society, March 27.—Annual general meeting.—Mr. Thomas Steel, president, in the chair.—Presidential address: Some questions in terrestrial physics: T. **Steel.** The first section was devoted to a discussion of radium

and the earth's internal heat, the nature of radium and the phenomena accompanying its disintegration being described. The consequences of the acceptance of the theory that the present internal heat of the earth is due to radium contained in the crust were detailed, and the immense importance of the theory in connection with the problems of geological time fully considered. The concluding portion consisted of a consideration of the question of the influence on climate of possible variations in the composition of the atmosphere, more especially with regard to its carbon dioxide content. The manner in which climate is influenced by the amount of this substance in the air was clearly described, and the causes leading up to its removal or replacement were discussed. Consideration was also given to the possibility of climate being influenced by the earth's internal heat. The address concluded with a brief account of some of the proofs of the former glaciation of the earth's surface to regions well within the tropics, and with the possible explanation of this phenomenon by mutations in climate caused by variations in the carbon dioxide in the atmosphere.—Ordinary monthly meeting, Mr. A. H. S. Lucas, president, in the chair.—Decapod Crustacea from Norfolk Island: the late F. E. **Grant** and Allan R. **McCulloch.**—Descriptions of Australian Microlepidoptera, part xix., Plutellidæ: E. **Meyrick.** In the "Handbook of British Lepidoptera," the family Plutellidæ was regarded as comprising the three groups Yponomeuta, Glyphipteryx, and Plutella. In the present paper, not without due consideration, the family receives a more extended application so as to include, in addition, Gracilaria and Zelleria, formerly included in the Tineidæ.

April 24.—Mr. A. H. S. Lucas, president, in the chair.—Descriptions of new or little-known Desmids found in New South Wales: G. I. **Playfair.** Dr. Otto Nordstedt has recorded nine species from the Blue Mountains, and Dr. M. Raciborski seventy-seven species from Centennial Park, Sydney, the papers of these two writers representing the only published contributions to a knowledge of New South Wales Desmids available at present. The material studied by the author represents about 350 species, of which 230 have been identified as forms not restricted to New South Wales, fifty require further investigation, and seventy are treated and figured in the present paper, of which fifty are regarded as previously undescribed.—Revision of the Thynnidæ (Hymenoptera), part i.: Rowland E. **Turner.** The present paper, part i., treats of the subfamilies Diamminæ and Thynninæ, the former comprising only one genus, Diamma, represented by a single species, and the latter seven genera and two subgenera, represented by 102 species, of which forty-six are described as new.—Contributions to a knowledge of Australian Foraminifera, part ii.: E. J. **Goddard** and H. I. **Jensen.** The material described in this and previous papers has been obtained from localities sufficiently far removed from one another to enable the authors to make deductions regarding the distribution of Foraminifera in Australian waters, and also to discuss the probable conditions of climate and deposition at the time the Table Cape beds were laid down.

CALCUTTA.

Asiatic Society of Bengal, May 1.—An abnormal branch of the mango (*Mangifera indica*, Linn.): I. H. **Burkill** and G. Chunder **Bose.** A young grafted mango bore two abnormal branches, which were leafy along one side, but flowering along the other. The internal anatomy of the larger branch was studied, and it was ascertained that the xylem was much more developed on the leafy than on the flowering side.—Note on the Shahin falcons (*Falco peregrinator* and *F. barbarus*): Lieut.-Colonel D. C. **Phillott.** Their habits, breeding, employment in falconry, and Eastern names.—Note on the red-headed merlin (*Æ salon chiquera*): Lieut.-Colonel D. C. **Phillott.** Its breeding, habits, and use in falconry.—Magnetic induction in spheroids: D. N. **Mallick.** This paper deals with the problem of magnetic induction in a magnetic substance in the form of a prolate spheroid, due to a current circulating in a wire wrapped round it along a part of its length.—The fats of Garcinia species: D. **Hooper.** The author enumerates four species of Garcinia the seeds of which are known to yield fixed oils, employed for lighting, edible, and medicinal purposes. Two of these have been examined by the author, who confirms the analysis of Heise in showing that the fat of *G. indica* consists chiefly of oleodistearin, and from an examination of gamboge butter, the semi-solid fat of *G. Morella*, its constitution is shown to be that of stearo-diolein.

DIARY OF SOCIETIES.

THURSDAY, JULY 4.

CHEMICAL SOCIETY, at 8.30.—*iso*Nitroso and Nitrodimethyldihydroresorcin: P. Haas.—The Structure of Carbonium Salts: F. Baker.—Studies of Dynamic Isomerism, Part VI., The Influence of Impurities on the Mutarotation of Nitrocamphor: T. M. Lowry and E. H. Magson.—The Relation between Absorption Spectra and Chemical Constitution, Part VIII., The Phenyl Hydrazones and Osazones of *a*-Diketones: E. C. C. Baly, W. B. Tuck, E. G. Marsden, and M. Gazdar.—Permanganic Acid: M. M. P. Muir.

ASSOCIATION OF ECONOMIC BIOLOGISTS (IMPERIAL INSTITUTE), at 11.30 a.m.—Some Notes on Ticks: C. Warburton.—A Remedy for the Spruce-gall and Larch-blight Diseases: E. R. Burdon.—Demonstration in the Public Galleries of the Imperial Institute by Mr. W. G. Freeman, the Superintendent of the Colonial Collections.—At 2 p.m.—A Note on the Cecidomyidæ or Gall-midges: W. E. Collinge.—The American Gooseberry-mildew, and the Proposed Legislative Measures: E. S. Salmon.—The Bionomics of the Calypterate Muscidæ, and their Economic Significance: C. Gordon Hewitt.

FRIDAY, JULY 5.

GEOLOGISTS' ASSOCIATION, at 8.—The Geology of the Appleby District, Westmorland: Dr. J. E. Marr, F.R.S.

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