THURSDAY, OCTOBER 17, 1901.

THE ENGINEERING LABORATORY.

Experimental Engineering. Vol. ii. Testing and Strength of Materials of Construction. By W. C. Popplewell, M.Sc. Pp. viii+404. (Manchester: Scientific Publishing Company, 1901.) Price 10*s.* 6*d.* net.

THERE is no doubt that the most striking feature in the increased provision of means for the scientific training of engineers during the last quarter of a century has been the great development of laboratories equipped for experiment and research in all branches of engineering. While as yet there is no general agreement as to the best avenue to the engineering profession, it is universally admitted that such a training as is possible in a well-arranged laboratory can be made a most valuable adjunct to any system of instruction or apprenticeship. This development alone has created a field for a series of text-books such as that of which the book before us is the second volume, while the fact that it is also intended to meet the needs of the large class regularly engaged in what is known as "commercial" testing serves to widen its scope, without in any way diminishing its value for more strictly educational purposes. The book contains a large amount of useful matter, collected with much discrimination from a great variety of sources, and we have little hesitation in saying that it will in very great measure meet the needs to which we have referred.

In his introduction, Mr. Popplewell explains that he has included a chapter on the mechanics of bodies under test loads, not with the view of instructing the novice in the fundamental parts of the subject, but simply in order to explain briefly the leading principles involved, and to record the formulæ to be afterwards used. Such brief explanations of general principles, however, are almost always unsatisfactory in themselves; it so often happens that in arriving at a simple formula the important matters are those which are omitted, so that the subject is presented to the student in a garb of spurious simplicity. Again, the student, allured by the brevity of such explanations, is strongly tempted to confine his investigation of the principles to the explanatory chapter and to overlook the author's disclaimer. The results of this tendency are only too apparent in the bald proofs so familiar to every examiner in the subject. And further, apart from its expressed limitations, Mr. Popplewell's chapter of theory is in itself in some respects open to criticism.

It is, for instance, important that the measure of a "strain" should be a number representing what may be called the strain-ratio, so that for any elastic deformation we have the simple relation

$$\text{strain} = \frac{\text{stress}}{\text{modulus}},$$

the modulus being the stress which would produce unit strain. We find, however, that while "strain" is correctly defined on p. 14, the very next page presents us with the unhappy equation

$$\frac{\text{stress applied}}{\text{modulus of elasticity}} = \frac{\text{amount of strain}}{\text{original length of the prism}}.$$

The discussion, again, of the relation between E and G, the moduli of elasticity and of rigidity respectively, is cumbersome and might be much simplified, and although it is pointed out that the result (that G is to E as 2 is to 5) depends on assuming that Poisson's ratio has the value 4, which is only partially justified by experiment, this result is quoted on p. 216 as having been deduced in the earlier chapter from purely theoretical considerations. Generally speaking there is a marked lack of elegance about Mr. Popplewell's mathematics; special instances of his cumbersome style may be found on p. 40, and again on p. 160.

On the other hand, he has done well to call special attention to the difference between the twisting moment in a bar in which, the state being entirely elastic, the stress is proportional to the radius, and that in a bar in which, the plastic state having been reached, the stress may be regarded as uniform over the section, a distinction which is sometimes lost sight of in reducing and comparing the results of observation.

The second chapter, a long one, is devoted to the description of testing machines, and the comparison of the advantages and disadvantages of the various types of large machines in general use will be found of great value not only by the works manager or teacher who may require a machine to suit special conditions, but also by the intelligent student, who is only too apt to regard the particular machine, on which it may be his lot to work, as embodying all the virtues, or it may be all the vices, of its kind. Many of the illustrations, particularly the diagrammatic views of different types of machines, are very good, and for a few more of these we could well spare the half-dozen or so of photographs, which have in most cases been taken in a bad light and have all suffered in reproduction. It is a pity to burden a text-book with general views which can be found, reproduced in much better style, in the makers' catalogues.

It were vain to attempt anything like an exhaustive description of the various measuring appliances now in use, as it seems to be a point of honour for each laboratory to design a special type, but Mr. Popplewell gives a short and sufficient account of the more familiar extensometers and gauges. More perhaps might have been said of optical methods of measurement, particularly of appliances depending on the principle of the optical lever, which is now largely used in many laboratories, or embodying a delicate spirit level, of which one instance only, Prof. Unwin's extensometer, is described.

Special chapters are devoted to descriptions of the methods of carrying out various tests in tension, compression, bending and torsion, and of recording and reducing the results, and these chapters are well done. In the account of bending tests we notice no reference to the bending of long rods of small section. Even if these tests are not of importance from the commercial point of view, they are of value in the laboratory from the simplicity of the apparatus and the ease with which the properties of different materials can be compared, and from the fact that elastic displacements large enough to be accurately measured with micrometer eyepieces can be used.

Several torsion machines are described, and the difficulty of obtaining a pure twisting couple is pointed out. It is the case, however, that in many of the torsional machines in ordinary use the method of measuring the

torsional deformation is not sufficiently accurate to justify elaborate precautions against bending moments, although it is not difficult to devise quite simple apparatus for making these angular measurements. These simpler means are somewhat overlooked by Mr. Popplewell, but an excellent account is given of the more elaborate and accurate instrument designed by Mr. Coker.

We are glad to find that our author, while describing several of the standard forms of apparatus for taking autographic records, is alive to the fact that these records are of secondary importance so far as the determination of the properties of the material is concerned, although undoubtedly of great use in exhibiting the nature of these properties. In educational testing especially, as indeed in all laboratory work, there is a danger of fostering too great reliance on autographic records, and the supreme value of first-hand observations cannot be too strongly insisted on.

It must suffice here to mention that the sections of the book which deal with the tests of ropes, chains, struts and so on are sufficient for their purpose, that there is a useful account of cement testing, although perhaps enough weight is not allowed to the personal factor in mixing, and that tests of the other materials of building construction are also briefly dealt with. Some account is also given of the effect of varying conditions, such as temperature, annealing, and bending, on the properties of metals. The effect of repeated stress and of reversed stress is dealt with in Chapter xi., and it would add considerably to the practical value of this chapter if a description of some of the standard pieces of apparatus used in making these tests were included. The account of timber testing is somewhat brief, but the general course of such tests is described and some standard determinations are quoted.

In his final chapter Mr. Popplewell has collected and tabulated a large number of determinations of what he calls the strength properties of the various materials considered, and this chapter, which seems both comprehensive and up to date, will undoubtedly be much used for reference by all who have occasion to consider these properties. He also adds a bibliography of books and memoirs.

We find no reference to the microscopic investigation of the structure of metals, a subject which has so much advanced of late years. The subject, indeed, demands a volume to itself, and at present perhaps is more in the province of the metallurgist than in that of the engineer, but its application to the investigation of flaws in structural parts has already given it a practical bearing which ought not to be overlooked.

Throughout the whole volume the need of occasional calibration of any testing machine in ordinary use is not indicated, nor is any description of the methods usually adopted in carrying out such a calibration given. This is a matter of such importance from a practical point of view that we must attribute the omission to inadvertence, and it will no doubt be rectified in another edition. On the whole, notwithstanding the few omissions and defects to which we have thought it necessary to call attention, we heartily commend the book to all who have to do either with the commercial testing of materials or with the management of the testing departments of engineering laboratories.

A NEW SURVEYING INSTRUMENT.

Der Hammer-Fennel'sche Tachymeter-Theodolit und die Tachymeter-kippregel zur unmittelbaren Lattenablesung von Horizontaldistanz und Höhenunterschied. Von Dr. E. Hammer, Professor an der K. Technischen Hochschule in Stuttgart. Mit 16 Figuren im Text und 2 Lithographierten Tafeln. Pp. 52. (Stuttgart: Konrad Wittwer, 1901.)

PROF. HAMMER has long occupied himself with the problem of constructing an instrument which should give the surveyor the necessary data for plotting his work with the least possible difficulty. Indeed, his numerous references to his previous work, and to the criticisms he has from time to time offered on the work of others, make his introduction not a little difficult to read. But, since the history of his work connected with tacheometers is set out with true German completeness, it may be valuable to anyone who is working on similar lines. In 1893 the author began to solve the following problem: to devise a tacheometer-theodolite, by which at one operation and without reading an altitude circle the observer could determine both the horizontal distance and the difference of altitude of a selected spot from the instrument. This problem the author now claims to have satisfactorily solved, and the instrument is on the market; but notwithstanding this long preparation we gather that several small improvements touching the arrangement of the microscopes and the general mounting of the instrument are still contemplated.

The optical part of the instrument consists of a so-called Porro object-glass, in which two lenses are kept at a constant distance from each other. The principal object-glass has a focal length of 350 mm., and the second lens, placed at a distance of 340 mm., 220 mm., giving to the entire system a focal length of 335 mm. The focussing is effected by moving the object-glass, and the eyepiece views a diagram of peculiar construction on which the effectiveness of the instrument depends. No compass or altitude circle is furnished with the tacheometer, but these can be added if it is desired to use the instrument as a transit theodolite or for other purposes. Instead of an altitude circle, a prism is placed at the side of the telescope above the axis, in connection with which is a carefully constructed diagram, arranged to a scale, by which can be shown the amount of tilting given to the telescope. A second prism placed behind the ocular throws an image of the diagram into the field of view, and as the telescope is moved up or down the diagram is moved to the right or left of the field, thus causing the lines of the diagram indicating the amount of inclination to cut the vertical wire in the eyepiece at a different place. The diagram and mechanical adjustments are so arranged that by multiplying the observed displacement of the line from the zero by 20, the difference of altitude in metres will result, while another displacement multiplied by 100 gives the distance. Very great care seems to have been bestowed on the construction of the field diagram on which the accuracy of the instrument must much depend. The correctness of the coefficient could no doubt be effectually checked by the measurement of known distances and of differences of altitude. Some little inconvenience, it would seem, must arise from the

fact that the zero of altitude does not correspond with the axis of collimation of the telescope. This displacement of the zero line has been necessitated by the desire to make the instrument available for the measurement of differences of altitude amounting to 30°, and to get the resulting displacement for such elevation it was necessary to use more than the semidiameter of the field. The author discusses the amount of error likely to arise from this cause and puts the result in a tabular form. Very full descriptions of the method of adjustment are given and some very practical remarks are made on the method of using the apparatus.

To judge by the examples that the author has given, the instrument should prove very useful in the hands of an expert. These examples show that in the measurement of a distance of 250 m. an error of about 0·6 m. may be apparent, while the average error in elevation over the same distance, and in which the variation of level amounts to about ± 7°, will amount to a few centimetres.

OUR BOOK SHELF.

Results of Meteorological Observations made at the Radcliffe Observatory, Oxford, in the eight years 1892–99. Edited by Arthur A. Rambaut, M.A. (Dubl. and Oxon.), Sc.D., F.R.S., Radcliffe Observer. Vol. xlviii. Pp. xxiv + 245. (Oxford : J. Parker, 1901.)

THE publication of a collection of meteorological observations made in 1892 may at first sight appear somewhat belated, and as giving promise of but little interest. But observations such as the greater part of those contained in this volume serve two purposes. There is first of all the immediate application of knowledge concerning the atmospheric variations whose usefulness is shown in weather prediction and similar purposes. Some may think that this is the main, if not the only, outcome of meteorological inquiry. But, apart from all ephemeral interests, the maintenance of a continuous record of the behaviour of the atmosphere is of great importance. The study of climatic oscillations throughout long periods is a study that is likely to be attended with great advantage and instruction. The long, costly and laborious series of observations, that are so carefully prosecuted at so many stations, can only be justified by their use in investigations which aim at the primary causes of atmospheric disturbance. The records of the Radcliffe Observatory hold a deservedly high place in such series, both for accuracy and for length of time during which they have been uninterruptedly pursued, and for the purposes of scientific meteorology the value of the present volume is undiminished by the length of time that separates us from the earlier observations. It will take its place among many worthy companions and hand on the history of the variation of climate to those who have the skill to read it.

A feature of great additional interest is given to the present volume by an inquiry into underground temperatures at various depths by means of platinum-resistance thermometers. This inquiry was originated under the direction of the late Mr. E. J. Stone, and has been vigorously prosecuted by the present director. The thermometers are placed at depths varying from six inches to ten feet ; a greater depth, which was originally contemplated, being found impracticable owing to the presence of water in the soil. The present inquiry is limited, but precise. It concerns itself with the variation of temperature in dry gravel ; and the thermal conductivity of a water-logged stratum, or of one greatly differing in constitution from that here investigated, does not come into consideration. The main conclusion to which the Radcliffe Observer is led in this investigation into the physics of the earth's crust is, that the annual variation of temperature is reduced to 0°·1 F. at a depth of 45·3 English feet, and to 0°·01 F. at 66 English feet. The semi-annual wave has the same limits at 21·4 and 36 feet, respectively. The temperature curves for the separate months of the year on which this result is based are shown graphically in a plate possessing many features of interest.

But of equal, if not of greater, importance is the inquiry into the accuracy of the thermometers themselves and their suitability for such investigations. One gathers that although very considerable difficulty was experienced at the outset, and not unnaturally with a novel kind of apparatus, these thermometers have stood the test with great satisfaction and proved themselves more trustworthy and more convenient than the long-stemmed spirit thermometers ordinarily employed in similar researches, and against which some obvious objections can be urged. The main difficulty in the use of the platinum-resistance thermometer seems to arise from a damp atmosphere affecting the connecting wires and impairing the insulation, but with sufficient precaution the recording apparatus is most sensitive and permanent.

The Telephone System of the British Post Office. By T. E. Herbert. Pp. xi + 218. (London : Whittaker and Co., 1901.) Price 3*s.* 6*d.*

MR. T. E. HERBERT describes the book before us as a practical handbook, and, from certain expressions used in the second chapter, he seems to be one of those practicians who have not overmuch sympathy with theoretical workers. It is not perhaps to be wondered at, therefore, if the preliminary chapters of his book, dealing with the fundamental principles of sound, electricity, magnetism, and telephony are handled in a very unsatisfactory manner. We are afraid that a reader, if he has not already acquired a thorough knowledge of the subject, will be liable to form erroneous impressions. Thus, to give one example, Mr. Herbert states that in an induction coil "the E.M.F.'s generated in the secondary coil are directly proportional to the current variations in the primary." Again, the description of the action of the Bell transmitter is, we are inclined to think, incorrect, as the same mistake is made here of not properly allowing for the time taken over a vibration of the diaphragm.

The greater part of the book is devoted to a detailed consideration of the apparatus and connections used by the Post Office. This would have been greatly improved if more care had been taken with the diagrams. It is a great pity that in a book of this kind, where clearness in the illustrations is so important, the lettering should be in some cases so small as to be unreadable. It is to be regretted, too, that such words as "nextly" and "inoxidible" are allowed places in the text. In spite of the defects, some of which we have tried to point out above, we have no doubt the book may prove useful to telephone engineers who are anxious to be helped over some of their practical difficulties, and are not particular about a clear understanding of the groundwork of their science.

Maps : their Uses and Construction. A Short Popular Treatise on the Advantages and Defects of Maps on Various Projections, followed by an Outline of the Principles involved in their Construction. By G. James Morrison, Memb. Inst.C.E., F.R.G.S. Pp. viii + 110. (London : Edward Stanford, 1901.) Price 5*s.* net.

A BOOK in English on map projections has long been needed, and the present work is a very welcome attempt to meet this need. It may be commended to all who have to deal with geographical questions, and to teachers of mathemathics and practical geometry who wish to find fresh exercises for their pupils.

The volume consists of an introduction, a popular account of eight common projections, followed by another

chapter dealing with the same projections in a slightly more advanced manner, and concluding with a discussion of projections of small areas. The popular description is exceedingly lucid, and the style is everywhere clear. The main defects of the book are that it is not sufficiently systematic, its nomenclature is occasionally at fault, the practical constructions in some cases are not the simplest, and the drawing of the diagrams is somewhat careless, so that statements in the text cannot always be verified on the figures. For Lambert's equivalent azimuthal projection, the author says there is no special name, and he calls Lambert's equivalent cylindrical projection simply the cylindrical projection. He omits Bonne's projection and both the Sanson-Flamsteed and Mollweide (Babinet's), all of which should receive some notice even in a popular work.

He rightly insists on the value of gnomonic projections for seamen, and of equivalent projections in our atlases; and desires the production of cheap and simplified globes.

A. J. H.

Smokeless Powder, Nitro-cellulose and Theory of the Cellulose Molecule. By John B. Bernadou, Lieut. U.S.N. Pp. viii + 200. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1901.) Price dollars 2·50.

THIS small work is of an entirely different character to the usual text-books on explosives, the author confining himself mainly to a theoretical consideration of his subject. To all interested in the manufacture or use of modern explosives the book should be of interest, throwing as it does much light on the theory of nitro-cellulose and mixtures containing this body, such as cordite or powders containing metallic nitrates with nitro-cellulose.

The book is divided into two parts, there being four appendices occupying considerably over half the volume. This latter portion is of most interest, for the author has collected together translations of the admirable papers by (1) Vieille, "Researches on the Nitration of Cotton"; (2) Mendeléef, "Pyrocollodion Smokeless Powder"; (3) Bruley, "The Nitration of Cotton" (an extension of Vieille's work). Appendix iv. consists of an abstract of a lecture by the author on the development of smokeless powder.

In the early pages concise definitions and a list of synonyms are given for the various substances dealt with, which avoids much confusion.

Some interesting work is recorded on the behaviour of guncotton at low temperatures. With liquid air it was found to be "not only not an explosive, but practically a non-combustible; while non-nitrated cotton under similar conditions is a violent explosive."

The remarkable action of very low temperatures in effecting solution of nitro-celluloses is dealt with at some length. McNab and others have shown that an insoluble nitro-cellulose becomes soluble in ether-alcohol at $-50°$, and the author shows that these bodies are soluble in ethyl ether under the influence of intense cold, and with the exception of the highly nitrated insoluble variety, they are soluble in absolute alcohol under similar conditions.

Lieut. Bernadou, in the latter part of the book, advances an ingenious theory of progressive impulses in guns when firing nitro-cellulose-nitro-glycerin charges, or colloided nitro-cellulose with metallic nitrates incorporated. With cordite, for example, "conditions point to there being two intervals in the decomposition of the charge, during one of which a maximum quantity of nitro-glycerin, and, during another, a maximum quantity of nitro-cellulose is burning." Finally, there may be a third impulse due to combination of the gaseous products. This latter appears to obtain confirmation from McNab and Ristori's analyses of the products from the materials separately and cordite (*Proc.* Roy. Soc., lvi. p. 8.)

In the space of a short review it is impossible to deal in a satisfactory manner with the author's theory of the cellulose molecule, many points being open to debate. The author's formulæ show four OH groups in the unit molecule $C_6H_{10}O_5$, which necessitates the assumption that on nitration some of these groups are unattached, whereas if the molecule is considered as having only three OH groups the limit of nitration is easily accounted for. Again, we are asked to assume that at low temperatures ethyl alcohol "under strain" has the composition usually associated with methyl ether, and that colloidisation is brought about by half molecules of ether or alcohol (under strain!) combining with half molecules of the nitro-cellulose.

J. S. S. B.

Catalogue of the Collection of Birds' Eggs in the British Museum (Natural History). Vol. i. By E. W. Oates. Pp. xxiii + 252. Illustrated. (London: Printed for the Trustees, 1901.)

WE have received from the Trustees a copy of this carefully compiled and beautifully illustrated volume, which reflects the greatest credit on all concerned in its production, and should prove invaluable to all ornithologists and egg-collectors. As a matter of fact, it is somewhat more than is indicated by its title, for the exquisitely coloured plates illustrate the chief types of egg form and coloration characteristic of the various groups of birds, so that it forms to a great extent a manual of "oology." We do not on the present occasion propose to review the volume in detail, reserving this till the work is completed. It may be mentioned, however, that the work is practically unique of its kind, the only other catalogue of eggs published by the Museum having been issued so far back as 1852, and treating only of British birds.

The Trustees have been well advised in securing the services of Mr. Oates, whose previous experience rendered him peculiarly qualified to undertake this important task. Of late years, owing largely to generous donors, the collection of eggs in the Museum has increased by "leaps and bounds," and is probably quite unrivalled elsewhere. At the present time it includes more than 50,000 specimens; but even this vast number, according to the author, represents only about one-third of the known species of birds. An interesting feature of the volume is the account of the growth of the collection, which forms a large part of the introduction.

With the bare statement that it includes the eggs of the ostrich-like birds, the tinamus, game-birds, hemipodes, sandgrouse, pigeons, rails, grebes, divers, penguins, petrels, auks, and gulls, we take leave, for the present, of a most valuable and instructive volume. R. L.

LETTERS TO THE EDITOR.

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

The Colours of Guillemots' Eggs.

YOUR reviewer, in dealing with Mr. R. J. Ussher's work on the birds of Ireland (see NATURE, November 29, 1900, pp. 101 and 102), had his attention particularly drawn to two statements concerning the eggs of the guillemot. In the first of these, which occurs on p. 364 of his book, Mr. Ussher puts forward the suggestion that "the beautiful varieties of colouring must help each bird to distinguish her egg from others lying near *until they all become stained and soiled*" (the italics are mine). This is certainly a very pretty hypothesis; but is not the earlier part contradicted by the part I have italicised? It is certainly indirectly contradicted by a statement on p. 365, where Mr. Ussher records his belief that when the eggs of the guillemot are found, as they sometimes are, in the nests of cormorants and kittiwakes, "the owners of the nest incubate the mixed clutches, and not the

guillemots, for I have noticed (he writes) a kittiwake chase away one of the latter from its nest."

If this be so, may we not doubt the propriety of supposing that a probably not very intelligent bird like the guillemot has a better eye for varieties of egg coloration than the kittiwake or cormorant, which cannot distinguish the strange egg dropped in its nest? And if the guillemot has a keen eye for colour, and if this faculty be as useful to the bird as Mr. Ussher suggests, is it not remarkable that natural selection should have permitted the speedy obliteration by stains and soiling of such important guide-marks? Is it not also remarkable that the guillemot, which, on the above-stated theory, needs distinctive marks to guide her to her own egg, should so easily dispense with these marks when her egg is hatched and her young one, so like its fellow-chicks, stands before her?

Why, again, should each guillemot be provided with a conspicuous private egg-pattern when other sea-birds, her neighbours, have to find their homes without such aid?

We have no right to suppose that the guillemot needs guide-marks to enable her to perform acts which are simple in comparison with those performed by many other birds and mammals. The guillemot's egg is stationary. The young of the fur-seal wanders widely amongst thousands of its similar brethren, yet its mother, even after days of absence, never fails to recognise it and will be satisfied with no other. So, too, travellers in the Antarctic tell us that the penguins[1] of that region have no trouble in finding their own offspring. There is no need, however, to multiply instances of what is a perfectly well-known faculty in gregarious animals.

I cannot think that this theory of Mr. Ussher's, so easily made and proportionally difficult to disprove, accounts for the facts of the case.

On the whole, I am inclined to doubt if any *conscious* act of recognition be involved in the return of each guillemot to her own particular egg; for we know that many sea-birds, probably fearing the robberies of the larger gulls, do not willingly leave their eggs unprotected, so that in natural conditions a bird may never actually have to find its egg, but rather its mate whose turn of duty has expired. It seems to me, then, highly probable that, if any conscious act of recognition be involved, it must be dependent upon smell or some other kindred sense.

But surely it is simpler to regard the varied colours of the guillemot's eggs as due purely to a waste product of the bird's metabolism, a product which in some birds, of which the guillemot must be regarded as one, would be forthcoming in abundance at the exciting season of the year, when all the organs of the body are more or less upset by the reproductive processes?

If this view be adopted, diversity of colour follows almost as a matter of course. For it is natural to suppose that in a case like this, where eggs are laid side by side in such large numbers, the question of coloration is unimportant and any colour is admissible which is consistent with the chemical constitution of each particular bird. When I look at a series of eggs of the guillemot I am always reminded of a herd of domestic cattle or a flock of barn-door fowl. In these, when no artificial selection has restricted the colour, the variation is extremely abundant. Like that of the guillemot's egg, however, it has its limits, due to the possibilities of the chemical combinations in the animal concerned. So that while red guillemots' eggs are rare, blue and green cattle are unknown. Further, while in some cases, as in cattle and the eggs of the guillemot, the variation is rich, in others, as in the ass and the eggs of the hedgesparrow, for instance, the range of variation, for reasons at present unknown to us, but probably differing in each instance, is comparatively restricted.

In conclusion, I must add that I am in no sense an opponent of the prevailing theories of protective coloration in birds' eggs as a whole. Such protective colouring almost certainly exists, but I doubt if it be nearly as extensive as is generally supposed, and I would suggest that the coloration is in many cases purely physiological, an aspect of the question which has assuredly been too much nelected.

Orange River Colony. G. E. H. BARRETT-HAMILTON.

Addresses of Authors of Scientific Papers.

MAY I be allowed, through the medium of your columns, to point out the inconvenience that is caused by the omission of an address on authors' separate copies of scientific papers?

Several papers have reached me recently containing valuable and interesting results, but there is nothing to guide me in my search either for the authors' addresses or, in some cases, the name of the periodicals in which their papers were originally published. I am unable, therefore, to acknowledge the receipt of their gift, to send anything in exchange, or to enter into private correspondence with them on their results.

SYDNEY J. HICKSON.

The Owens College, Manchester, October 4.

The Recent Inverness Earthquake.

IN NATURE for September 26 it is stated that the recent Inverness earthquake was not felt in Edinburgh or Glasgow, and apparently the Milne seismograph at the Royal Observatory in the former city gave no indication of any movement. The shock, however, was distinctly felt in Paisley, a few miles west of Glasgow. There are in the Coats Observatory here two seismographs. One of these is a Milne, and it gave no record; but the other, which is Prof. Ewing's, marked the occurrence of the shock. The time as nearly as could be ascertained was 1h. 21m. 35s. The lateral movement was very slight.

ANDREW HENDERSON.

Paisley Philosophical Institution, Paisley, October 14.

THE VIRCHOW CELEBRATION.

A FEW days ago representatives of the world's science met in Berlin to do honour to one of the world's veteran men of science. The occasion of Prof. Virchow's eightieth birthday was seized by many learned societies and private individuals to express their appreciation of the great debt owed by mankind to this epoch-making thinker and worker. The Emperor of Germany bestowed upon him the great gold medal, and the King of Italy a picture in which the Professor's portrait was accompanied by that of his great Italian forerunner, Morgagni. The idea to frame these two scientific men together, whose work, although separated by two centuries of time, illuminated the same branch of knowledge, was certainly a graceful one.

Prof. Virchow was the son of a small farmer in Pomerania, and was born on October 13, 1821. He studied in Berlin, and his first appointment was in connection with the Charité, a hospital which has numbered among its staff many men of European fame. Shortly afterwards Virchow was appointed University Lecturer. About this time he fell somewhat into official disfavour on account, no doubt, of his sympathy with the revolutionary movements of 1848. He left Berlin for the quiet University town of Wurzburg. Here he attracted numerous students and workers, and formed a pathological school which, even after he had quitted it, continued to be one of the best in Europe.

The work by which Virchow will always be known is his "Cellular Pathology." As Lord Lister truly remarked, workers of the present generation cannot conceive the effect which was produced upon the medical world by this book. In 1826 botanists began to regard plants as collections of cells; in fact, Schwann firmly established the position of the cell as the unit of vegetable morphology. Owing, no doubt, to the less distinctly defined characters of the animal cell, it was not until later that Kölliker and others extended the cellular theory to animal tissues. Virchow, in 1858, found a wider application for this theory and demonstrated that pathological tissues also were collections of cells, and that the phenomena of their growth was covered by the generalisation *omnis cellula a cellula*. From that time till to-day Prof. Virchow has been an active worker in pathology, combining the highest critical faculty with an apparently perennial assiduity. In London he is well known; not many years ago (in 1892) he received the Copley medal of the Royal Society, and at that time his great achievements were referred to

[1] See Racovitza, "La vie des Animaux et des Plantes dans l'Antarctique," published by the Société royale belge de Géographie, p. 51, 1900.

at length by the late Sir James Paget in one of his most felicitous speeches. In 1898 he delivered at Charing Cross Hospital the Huxley Lecture, in the English language.

Prof. Virchow has from very early in his career devoted considerable attention to practical hygiene and anthropology. His work upon prehistoric cave-men and Swiss lake dwellings may be taken as a type of the thoroughness with which he accomplished anything he undertook. Last, but not least, the great pathologist was, and indeed is, a politician of no mean order. He entered the Chamber in 1862 and served there till 1878. His work as a politician was devoted to the cause of liberty and truth, and even those who did not agree with his doctrines were unanimous in their respect of his motives.

It is sincerely to be hoped that the aged Professor may for many years to come continue his valuable work, and to all students of science no item of the varied programme of the Virchow celebration was more welcome than the astonishing vigour and youthful earnestness with which the object of their congratulations for two hours, addressed them.

F. W. T.

THE RECENT WORK AT STONEHENGE.

AT a meeting held last March at Stonehenge and attended by representatives of the Society of Antiquaries, of the Society for the Protection of Ancient Monuments and the Wiltshire Archæological Society, various plans and measures were discussed and suggested for the better preservation of Stonehenge. The whole state of the surrounding neighbourhood being changed from its former quietude by the introduction of new elements, such as the military camps at Bulford, &c., the making of the new branch line of the South-Western Railway (from Grateley to Amesbury), it became necessary to meet the altered circumstances by the exercise of greater precautions for the care of the beautiful old Sun Temple standing in the midst of the grass-clothed downs —a thing of wonder and mystery to behold. The advice given to Sir Edmund Antrobus by the representatives of these societies was as follows, published in the *Times* of April 3.

Resolutions.

(1) That this Committee approves of the suggested protection of Stonehenge by a wire fence not less than 4 ft. high, following on two sides the existing roads and crossing on the west from the 331-foot level on the north road to the 332-foot level on the south road shown on the O.S. map (1–2, 500), Wilts sheet liv. 14.

(2) That the Committee recommends, without prejudice to any legal question, that the local authorities be requested to agree to divert the existing track-way or ridge-way from Netheravon now passing through the earth circle so as to pass from the 302-foot levels in the O.S. map immediately west of Stonehenge.

(3) That stones 6 and 7 with their lintel, and stone 56 (according to the numbering on Mr. Petrie's plan) be first examined, with a view of maintaining them in a position of safety.

(4) That, in the opinion of this Committee, stone 22 should be replaced, stone 21 be made safe, and the lintel of 21 and 22 be replaced in the most safe and conservative manner. The Committee also recommends the re-erection of stones 57 and 58, and their lintel 158.

(5) That the instructions to custodians already in force be approved with a few suggested alterations.

(6) That this Committee feels that it is impossible to overstate the value of the assistance which the County Council of Amesbury can give to the efforts made to preserve this unique monument.

(7) That these resolutions be sent to Sir Edmund Antrobus with the earnest thanks of the Committee, for the part he is proposing to take in the preservation of Stonehenge, also that it be left to him to communicate with the Press.

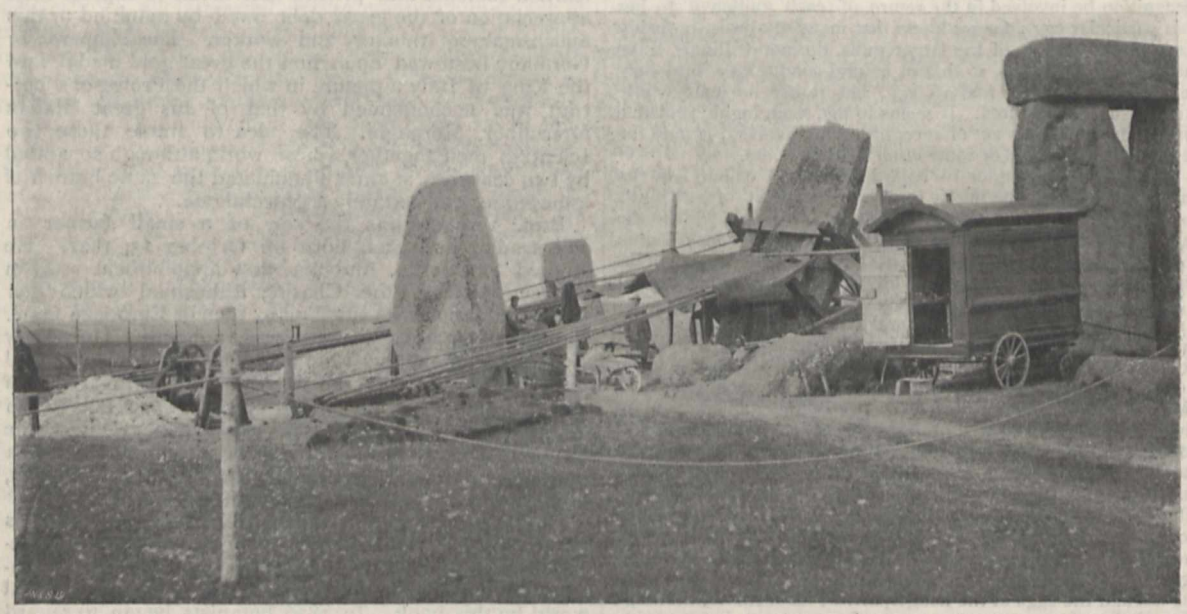

FIG. 1.—The work at Stonehenge. Raising the leaning stone.

The fence was erected by Whitsuntide and is 1700 yards in circumference and composed of lightest barbed wire of a neutral tint and absolutely invisible at a distance, so that the traveller gets the whole effect of Stonehenge in its full grandeur instead of, as in former days, the view of the stones mingled with two or three flys, a cart, an old waggonette, and photographer's van, &c., to say nothing of picnic luncheons, spread out within the sacred circle. This fence encloses as large an area as possible,

being well outside the vallum except on the west side, where a right of way interferes with the true circle. The next work undertaken—the most difficult and important of the whole—was the raising of the "leaning stone"—the largest monolith in England except Cleopatra's needle—to an upright position. This stone formed one of the uprights of the trilithon the fall of which was said to have been caused by the digging and researches of the Duke of Buckingham in 1620. The horizontal and the other upright (the latter broken in two pieces) now lie prostrate across the altar stone.

The great stone leaned considerably towards the N.E. and appeared to rest upon (actually touching at one point) a beautiful little pillar stone of syenite, the danger being that in some storm, especially after a heavy fall of snow and sudden thaw, the great stone would break in three pieces (having three veins) in falling, and also crush the smaller stone beneath it.

That a forward movement was continually taking place is shown by observations taken by Mr. Flinders Petrie some years ago. It then leaned at an angle of 62, which has been increased to one of 65 degrees lately. The work of the raising of the stone was begun on August 18 and finished September 25, and was under the direct supervision of Dr. Gowland, Mr. Detmar Blow, architect, and his assistant Mr. Stallybrass, and Mr. Carruthers, engineer. The first thing done was to make a fitting to the stone of a strong timber cradle so as to protect it from injury by the immense iron chains and ropes placed round it, these being attached to winches worked by men, so that the stone was actually "wound up," so to speak, into an upright position. Hydraulic jacks were also used. The whole thing was most carefully and slowly done, and devotedly watched over by workers. A rectangular excavation was made in front of the stone, a square excavation at the back. A frame of wood with numbers at equal distances apart was placed over the ground, which was excavated in sections, and the earth was most carefully sifted in layers through four grades of sieves in such a manner that the position of every object found could be recorded. The excavations round the base of the stone are now filled with concrete, and the large struts which uphold it will remain in their positions for six months, until the concrete be thoroughly set.

The objects found were one Roman coin at a shallow depth, and many chippings of both the blue and sarsen stones. Numerous flint axe heads and large stone hammers were also found at a depth of from two feet to three feet six inches underground; all tending to prove the great antiquity of Stonehenge—at least Neolithic. But all this will be discussed scientifically later on.

FLORENCE C. M. ANTROBUS.

BIRD LIFE IN THE CANARIES AND SOUTH AFRICA.[1]

ALTHOUGH the author can scarcely be congratulated on his choice of a title, which in our opinion is too prolix and disconnected, he has succeeded in producing a very readable and interesting little work, based on a stay of six months in the Canaries and a sojourn of about the same duration in South Africa. Much of the contents is devoted to the ordinary incidents of travel, but the special feature of the book is formed by the excellent series of photographs of birds in their native haunts. As every one who has tried bird-photography is aware, but little can be done with the camera in this respect except during the nesting season; but the author's object has been, not to obtain pictures of the birds while actually sitting, but in their natural attitudes when in the neighbourhood of their nesting places. In this way it is possible to show birds in positions which could not be attempted in a drawing; and the value of such pictures for the guidance of the taxidermist who desires to be true to nature cannot be over-estimated. Apart from getting near enough to the bird without disturbing it, there are, however, difficulties connected with this branch of photography which can only be fully realised by those who have had practical experience.

The ideal way of showing a bird, as the author tells us, is perhaps to portray it amid its natural surroundings, but, with rare exceptions, this is unfortunately a practical impossibility in photography. The chief difficulty with which the photographer has to contend is the background—whether this should be in proper focus at the expense of the bird, or *vice versâ*. In most of the photographs the background has been sacrificed; the birds standing out against a dark background, due to out-of-focus distance behind them. This method has the advantage of bringing into relief the various markings and details of the plumage in a manner that would otherwise be impracticable; and, at any rate from the naturalist's point of view, the author is to be congratulated on the success of his method, many of the pictures being perfect representations of bird life.

In the section of the work dealing with the Canaries, a very considerable portion of the text, as well as some of the illustrations, are devoted to the description of the country, its inhabitants and its buildings, so that it is only here and there natural history subjects are discussed at any length. There are, however, several excellent photographs of the nests and eggs of birds—notably the stone-curlew and the Egyptian vulture; and we may call especial attention to the pictures of a malachite sun-bird and its nest (Plate xxii) as first-rate examples of what can be done by photography in portraying the smaller types of bird-life.

In the second part of the volume, which treats of the author's experiences in South Africa, the bird-lover will find a very large amount of interesting matter. Personally, we have been much attracted by the author's account of his visit to Bird Island and St. Croix, two islets lying off Port Elizabeth. Apparently no one is allowed to visit these bird-haunted islets without a special permit, and an amusing story is told of the difficulty of obtaining such permission in this particular instance. Bird Island is the chosen resort of the Cape gannet, and the following account, illustrated by two photographs, gives a good idea of the numbers of these birds in the nesting season:—

"We rounded the north end of Bird Island first," writes Mr. Harris, "and then, close to the lighthouse, and covering quite an acre and a half of ground, were to be seen thousands of Cape gannets. The ground was white with the birds themselves, while above them in the air a kind of kaleidoscopic effect was produced by the ever-moving wings. Among a crowd of birds so thickly packed together as these gannets were, one naturally wonders if it is possible for them to keep to their own eggs; perhaps each bird recognises its own special place from the position of its neighbour. . . . The men at the lighthouse say that these birds arrive in a mass at this, their breeding season, and that when the season is finished the island is untenanted as to bird life until the following year. The spectacle was not so imposing as that presented by the gannets on the Bass Rock in Scotland, where the birds, as seen from a distance, have the appearance of bees swarming round a hive. Here the birds were shown horizontally instead of vertically."

Penguins are likewise abundant on these islands, and the author was fortunate in obtaining two photographs of these birds, in one of which they are shown swimming, and in the other standing on the rocks.

Perhaps the most interesting chapter in the whole book

[1] "Essays and Photographs. Some Birds of the Canary Islands and South Africa." By H. E. Harris. Pp. xvi+212. 8vo. Illustrated. (London: Porter, 1901.)

is the one describing the nesting habits of the two species of sand-plover which frequent the shore on False Bay and in the neighbourhood of Port Elizabeth. The visitor unaccustomed to the ways of these birds always fails at first to discover their eggs, although he may be convinced that they are in his immediate vicinity.

After one or two attempts, says the author, you retire and resolve to watch more carefully. "The bird soon returns to the same spot, shuffles for a second or two very quickly with its feet, and then sits down. This time you make no mistake about the exact place, and you locate the position of the bird with the aid of two little bits of herbage growing near; again you approach, the bird rises as before, and repeats the same performance, standing a little way off, and looking as though it would help you if it could, and if you would only tell it what you were looking for. The ground is quite undisturbed, and there is no sign of a nest or eggs; the little bits of driftwood and bark, though, which lie between your feet are loose, and the earth underneath them is loose also, and then you feel beneath the loose earth and there are two eggs!"

And yet it is difficult to account for this strange habit, since the eggs so closely resemble their surroundings that they would be passed unnoticed when lying on the bare ground. Often the nesting-site is in a locality much frequented both by men and cattle, and it is a marvel that all the eggs are not broken. On one occasion the author actually found an ox lying down on a nest whose situation was known to him; strange to say, although one egg was crushed, the other was intact. The proceedings of the parent bird while thus effectually prevented from obtaining access to her nest are described with some humour by the author.

Many other anecdotes might be culled from Mr. Harris's pages, but enough has been said to indicate the interesting character of his work and the large amount of information with regard to the habits of birds that it contains. The author has been fortunate in obtaining the assistance of Mr. Howard Saunders in revising the nomenclature, so that ornithologists may be satisfied that the various birds alluded to are correctly identified.

R. L.

THE REPORT OF THE THOMPSON YATES LABORATORIES.

THE Thompson Yates Laboratories Report, lately published, edited by Profs. Rubert Boyce and C. S. Sherrington, is a worthy successor to the preceding volumes, which have previously been reviewed in these columns. The distribution of *B. coli commune* is the title of the first paper, by Miss Chick, who concludes that this organism is not so generally distributed as has been considered by some bacteriologists, and that its presence may be looked upon as useful evidence of recent fæcal contamination. Her experiments show the very low resistance which the *B. coli* can offer to unfavourable conditions, especially desiccation.

Cape Gannets on Bird Island.

Mr. E. E. Glynn has investigated the relation between the *Bacillus enteritidis sporogenes* of Klein and diarrhœa. He has isolated this micro-organism from normal dejecta, dust, air, milk, and sugar, and has tested the effects of cultures upon guinea-pigs and upon himself by ingestion without evil result. He agrees with Dr. Hewlett that the *Bacillus enteritidis sporogenes* is a ubiquitous organism, and that there is at present no satisfactory evidence that it is a cause of diarrhœa.

Mr. A. T. MacConkey gives further details of his bile-salt lactose Agar medium for the isolation of *B. coli* and *B. typhosus*, for which purpose it seems to be a valuable addition to the methods hitherto in use. Mr. MacConkey also publishes a note on flagella staining, Mr. K. W. Monsarrat describes a primary malignant growth of the kidney, and Dr. Christophers discusses the prevention of malaria in Tropical Africa.

Enlargement of the spleen has been relied upon by many as the test of the prevalence of malaria in a district, but Dr. Daniels concludes that the spleen-test may be

worse than useless unless race and age are taken into account.

FIG. 1.—Anopheles larvæ in several stages of their escape from the ova.

Two well-executed full-page diagrams by Messrs. Ross and Fielding-Ould illustrate the life-history of the parasites of malaria, while the last half of the volume is occupied with the Report of the Malaria Expedition to Nigeria of the Liverpool School of Tropical Medicine. The latter contains many good illustrations of the characteristics of the country and of the development of Anopheles. Two of these are here reproduced, one (Fig. 1) showing Anopheles as ovum and larva, the other (Fig. 2) a breeding-ground of Anopheles.

A portrait and short obituary notice of the late Dr. Myers and an illustration of the Kanthack Medal in Pathology also appear in this volume. All the papers are valuable contributions to the science of medicine, and we shall look forward with interest to the publication of future volumes. R. T. H.

FIG. 2.—Portion of a cultivated area at Lokoja, showing butts and furrows, in the latter of which Anopheles puddles occur.

NOTES.

THE Cape papers, says the *Times*, report the formation at Cape Town of a "South African Association for the Advancement of Science," to work as far as possible on the lines of the British Association. In July last a meeting was held to establish a congress of engineers, when an influential committee was appointed. The proposal gradually widened until at length it was found feasible to establish a local "British Association," and a meeting for that purpose, held under the chairmanship of Sir David Gill, F.R.S., the Astronomer Royal at the Cape Observatory, was largely attended, and the formation of the Association having been decided upon by formal vote, the title was discussed, "South African" being carried by 31 votes against 19 for "African."

A REUTER telegram of October 14 from Cape Town states that the *Discovery* sailed that day from Simon's Bay for Lyttelton, New Zealand.

THE resignation of Dr. John Young, professor of natural history and lecturer in geology in the University of Glasgow, is announced. Dr. Young, who was appointed in 1866 to the professorship he now vacates, will retain his connection with the Hunterian Museum, of which he has for a number of years been curator.

PROF. JOHN JOLY, F.R.S., has, subject to the approval of the Lord Lieutenant, been co-opted to fill the vacancy on the Irish Lights Board caused by the death of Mr. J. Pim.

MR. J. R. JACKSON, who for a period of forty-three years has been associated with the Royal Gardens, Kew, has resigned the keepership of the Museum of Economic Botany, and is succeeded by Mr. J. M. Hillier, whose place, in turn, has been taken by Mr. J. H. Holland, late of the botanic station at Old Calabar.

THE death is announced in the Allahabad *Pioneer Mail* of Dr. Vonkrafft, of the Geological Survey of India, who was appointed to India by the Secretary of State and has, since January, 1899, been mainly employed in the Himalayas.

THE fiftieth scientific anniversary of M. Berthelot (he began his career as a chemist in 1851) is to be commemorated, says the *Chemist and Druggist*, by the presentation to him next month of a metal plaquette by his colleagues of the Institute of France. On the front of the plate, which is the work of Chaplin, the engraver, the recipient's portrait will be reproduced in profile, and on the back M. Berthelot will be portrayed seated at his laboratory table, "Truth" illuminating him with a torch, and "Patrie" protecting him under a flag and offering him a crown of laurels.

THE first Egyptian Medical Congress will be held in Cairo, under the presidency of Dr. Ibrahim Pacha Hassan, from December 10 to 14 next.

AN Industrial and Art Exhibition will be held at Düsseldorf next year, and already the intending exhibitors number about 2300. The exhibition will embrace the following groups:—mines and saltworks; smelting works; the metal industry; machinery and electrical engineering; transport; chemical industry; articles of food, &c., and apparatus for preparing them; stone, earthenware, porcelain, cement and glassware; the wood and furniture industries, house decoration, &c.; fancy goods and small wares; the textile industry; clothing trades; leather, indiarubber and asbestos goods; the paper trade; the printing trade; scientific instruments; building and engineering; education; hygiene and benevolent institutions; sport; horticulture; agriculture and forestry; and art. As was the case with the Paris Exhibition of 1900, a large number of international and other congresses will be held at Düsseldorf during the exhibition.

THE general committee of the Photographic Salon will hold an "At Home" at the Dudley Gallery, Egyptian Hall, on Tuesday next, at 8.30 p.m.

THE next meeting of the Institution of Mechanical Engineers will be held to-morrow, the 18th inst., when Prof. Burstall will present the second report to the Gas-Engine Research Committee. At the November meeting of the Institution a paper will be read by Prof. Dalby on the balancing of locomotives.

A REUTER telegram from St. Petersburg states that a letter has been published in the *Turkestanskiya Viedomosti* giving the following information concerning Dr. Sven Hedin, the Swedish traveller, based upon a letter from him, dated July 10. It appears that Dr. Sven Hedin, at the time of the despatch of the letter, was at the foot of the Akka Tagh, in Northern Tibet, and intended to proceed in the direction of Ladak in order to survey accurately the region about the source of the Indus. Next spring he proposes to return to Osh *via* Kashgar. Meanwhile, a caravan of fifteen horses has arrived at Kashgar bringing the results of two years of the traveller's work in the shape of scientific collections, maps, photographs and diaries. Dr. Sven Hedin speaks in the highest terms of his Cossack escort and extols their courage, endurance and resource in critical situations. Up to the time of writing he had been in no way molested by the Chinese.

THE Liverpool School of Tropical Medicine, according to a Reuter telegram, has now completed the necessary arrangements for the despatch of an expedition at once to the Gold Coast, and to the mining districts there. Dr. Charles Balfour Stewart, under whose leadership the expedition will be, leaves for West Africa this month. He first proceeds to Sierra Leone in order to study the methods now being employed there with such success by Dr. Logan Taylor. After leaving Freetown, Dr. Stewart will go at once to Cape Coast Castle to attack the insanitary conditions there, as the mortality amongst the Europeans in that town is at present most serious. He is to adopt, under Major Ross's general direction, the latest methods known to science for obtaining the end in view, and will employ large gangs of workmen for draining the ground and clearing the houses of broken water vessels and otherwise attacking the breeding-grounds of the mosquitoes. As regards the movements of the expedition, these, to a great extent, will be determined by the Governor, Major Nathan, with whom Major Ross had a personal interview on the Gold Coast two months ago, when the Governor promised the expedition most valuable assistance. The expedition has been rendered possible owing to the generosity of a private individual who desires to remain anonymous. Anti-malarial operations will shortly be in full swing in the Gambia, Sierra Leone, the Gold Coast, and Lagos, the operations in the three first named colonies being organised by and under the complete control of the Liverpool School of Tropical Medicine.

IT has been decided that the house which Prof. O. C. Marsh bequeathed to Yale University shall in future be known officially as Marsh Hall, and the grounds in connection with it as the Yale Botanical Garden.

THE subject of the Fiske Fund Prize Essay (value 200 dollars) for the year 1902 is, says *Science*, "Serumtherapy in the Light of the most recent Investigations." The secretary of the board of trustees of the Fund, from whom all necessary information may be obtained, is Dr. H. De Wolf, 212, Benefit-street, Providence, R.I., U.S.A.

THE following awards have been made by the Institution of Civil Engineers for papers dealt with in 1900–1901:—A Telford Medal and Premium to R. P. Bolton; a Watt Medal and a Telford Premium to J. E. Dowson; a George Stephenson Medal and a Telford Premium to W. T. C. Beckett; a Manby Premium to E. K. Scott; a Trevithick Premium to T. A. Hearson; a Telford Premium to J. A. W. Peacock. For students' papers the awards are:—A Miller Scholarship (tenable for three years) and the James Forrest Medal to E. V. Clark; Miller Prizes to C. E. Inglis, H. E. Wimperis, J. L. Cridlan, F. K. Peach, G. H. Whigham, F. Taylor, A. C. Walsh and H. O. Jones.

A NUMBER of awards are to be made by the Industrial Society of Mülhausen, in 1902, among which the following may be noted:—A medal of honour and 400–800 marks, according to the value, for a handbook consisting of tables giving the density of the greatest possible number of mineral and organic combinations in crystal form and in saturated cold solutions. The solution-capacity at other temperatures is to be added to the work as a supplement. A silver medal for the synthesis of a product possessing the most important qualities of Senegal gum capable of use in textile industries. A medal of honour and 800 marks for a substance which may be used as a cheaper, substitute for dry egg-albumen in the printing of fabrics. A medal of honour and 800 marks for a colourless blood-albumen which will not become coloured when steamed. A silver medal for a handbook treating of the analysis of the drugs used in calico-printing and in dyeing. A silver medal for an ink which can be used for marking woollen fabrics to be dyed red, brown, or any other dark colour. This ink must remain visible after all the dyeing processes. A silver medal for a practical process of removing spots of mineral-fat from fabrics. A silver medal for a treatise on the preparation of hydrogen peroxide, and its application for bleaching textile fabrics. For these prizes foreigners are allowed to compete. All drawings, samples, &c. should be marked with a motto and sent before February 15,

1902, accompanied by a sealed envelope containing the name and address of the competitor, to the Präsidenten der Industriellen Gesellschaft, Mülhausen, Alsace.

PRIZES are offered by the English Arboricultural Society for the best essays on the following subjects:—The more extensive cultivation of hardy flowering shrubs; the arboricultural management of private and public parks; an essay on any insect or group of insects injurious to forest trees; the natural regeneration of oak and beech woods; on the management of young trees, with the view of rendering them suitable for planting in avenues, streets and other places; the relative durability of British-grown exotic trees; on the growth and freedom from disease in this country of larches, other than the common European larch; the financial aspect of forestry, with special reference to actual cases. In addition to the foregoing, Mr. H. J. Elwes, F.R.S., offers a special prize for a paper on natural reproduction of trees by seed in England. The next annual meeting of the Society will be held in France.

THE following gentlemen have been nominated to serve on the council of the London Mathematical Society for the ensuing session:—President, Dr. Hobson; vice-presidents, Prof. W. Burnside and Major MacMahon, R.A.; treasurer, Dr. J. Larmor; hon. secs., R. Tucker and Prof. Love; other members, J. E. Campbell, Lieut.-Colonel Cunningham, R.E., Prof. Elliott, Dr. Glaisher, Prof. M. J. M. Hill, H. M. Macdonald, Prof. L. J. Rogers*, A. E. Western, E. T. Whittaker and A. Young*. Those marked * are new nominations. The retiring members are Lord Kelvin and Mr. A. B. Kempe. The annual meeting will be held at 22, Albemarle-street, W., on November 14, at 5.30 o'clock.

EXPERIMENTS have recently been made in the State of Connecticut for the purpose of cultivating the Sumatra tobacco plant. It is stated that the experiments have been very successful, and great interest is now being taken in the matter in order to improve the quality of the Connecticut leaf, which is much used as a wrapper for the better quality cigars.

MAJOR RONALD ROSS informs the *British Medical Journal* that he has recently received a communication from a Jamaica correspondent drawing his attention to the fact that mosquitoes are responsive to certain sounds, such as a continuous whoop or hum. Major Ross's informant states that swarms gather round his head when he makes a continuous whoop. There may be, however, he says, some particular note or pitch that would be more attractive to them.

AT the recent meeting of the American Association, in the Section of Chemistry, Prof. J. H. Long, president of the section, delivered an interesting address on the teaching of chemistry in the medical schools of the United States. The first part of the address was devoted to sketching historically the teaching of chemistry in the American medical schools. A prominent individuality in this connection was Dr. Robert Hare, whose great merit apparently consisted in the ingenuity he displayed in contriving experiments to illustrate simple chemical principles to medical students. While Hare was prominent in Philadelphia, Silliman, Gorham and Mitchell were developing the departments of medical chemistry in Yale, Harvard and Columbia. The next step in the teaching of chemistry to medical students was the institution of laboratory courses; this did not take place at Harvard until 1872. Subsequently to this an important question arose as to the qualification of the teacher of so-called medical chemistry. Since, formerly, the main use of chemistry to the medical student lay in its direct application to pharmacy it was held that this subject was best taught by a physician; the growth, however, of physiological chemistry, and the obvious relation of chemical principles to physiology and pathology, rendered it of the first importance that medical students should be well grounded, not only in the properties of isolated substances as heretofore, but in the actual principles of organic and inorganic chemistry. A trained chemist alone was competent to teach upon these lines, and hence the medical chemistry taught by the physician became replaced by chemistry taught by a chemist. The remainder of Prof. Long's address dealt with the far-reaching importance of chemistry, inorganic as well as organic, to the medical student, and the inadequacy of mere analytical courses, into which there is apparently some danger of the teaching of chemistry degenerating. He emphasises the fact, well recognised in this country, that the burning problems of the physiology, the pathology and therapeutics, if not of to-day, certainly of the near future, are essentially chemical, and instancing the work of Bredig upon the fermentative action of colloidal platinum, &c., points out that they are by no means necessarily confined within the accepted limits of so-called organic chemistry.

THE Imperial Department of Agriculture for the West Indies maintains its activity in supplying the colonists with the most trustworthy information bearing upon the various subsidiary industries which should, with a little energy and patience, bring about a great improvement in the welfare of the islands. Pamphlet Series, No. 9, now being distributed, deals with "Bee-Keeping in the West Indies." In Europe and America there is a large and ever-increasing demand for honey and beeswax, yet the West Indian islands, with their dozens of varieties of honey-bearing flowers all round the year, may be said, with the exception of Jamaica, to have thus far made no real attempt to regard bee-keeping as worthy of encouragement. Mr. W. K. Morrison, formerly of the United States Department of Agriculture, has been engaged by Dr. Morris as expert adviser to the Imperial Department, and he has been touring amongst the islands during the first half of the present year studying the conditions and prospects of bee-keeping. The outcome of his investigation is this pamphlet of 73 pages, conveying to all who wish to increase their income in an easy manner simple hints and suggestions as to the requirements of tropical bee-keepers. Only a small capital is required to make a good start, and the profits are large so long as a sound and attractive article is produced. It is indicative of the natural carelessness of the colonists that it should be considered necessary to dwell upon this weakness, for in insisting that a high standard of excellence is required to secure remunerative prices on the European markets, it is added that "The great danger to West Indian bee-keeping will probably lie in the tendency to ship abroad honey or wax of an inferior quality." The pamphlet, which is illustrated, is a veritable storehouse of instruction, and should be the means of originating an industry which may add considerably to the wealth of the islands.

PROF. T. LEVI CIVITA, writing in the *Atti dei Lincei*, discusses the law of fluid resistance, and in particular the property that this resistance varies approximately as the square of the velocity, as a consequence of the properties of discontinuous motion in a perfect fluid. The author obtains for the most general case an expression for the resistance in the form of a series of even powers of the velocity, which series is convergent for velocities below a certain limit, and in the cases commonly occurring in practice reduces approximately to its first term, giving Newton's law.

IN a recent *Bulletin* of the Agricultural College at Tokyo there is an investigation by Mr. Aso on the causes of the difference in colour between green and black tea. In making green tea the leaves are steamed as soon as gathered; in the case of black tea the leaves are allowed to ferment before drying. The

finished black tea contains much less tannin than the green. The author shows that the original tea-leaf contains an oxidising enzyme, which is destroyed by heating to about 77° C. During the fermentation of the leaf in the manufacture of black tea this enzyme oxidises the tannin, giving rise to a brown product.

THE June issue of the *Monthly Weather Review* of the U.S. Weather Bureau has a note stating that an observer at Tillers Ferry, South Carolina, had reported that during a heavy local rain in June there fell hundreds of small fish (cat, perch, trout, &c.), which were afterwards found swimming in the pools between the cotton rows in a field. "It is," says the *Review*, "a well-known fact that in such rains all sorts of foreign objects, whether sticks or stones, frogs or fish, or even débris of destroyed houses and crops, occur occasionally, not only in America, but in Europe and elsewhere. It is very rare that we are able to trace these objects back to their sources, but there can be no reasonable doubt that they were carried up from the ground by violent winds, such as attend thunderstorms and tornadoes."

INTERNATIONAL balloon ascents (both manned and unmanned) were undertaken by several countries on July 4 and August 1. The greatest heights at which records were obtained in July were at Trappes, near Paris, 10,270 metres, temperature −52° C. (on ground 16°·5), and at Chalais Meudon, 10,260 metres, temperature −43° (on ground 16°·7). In August, the greatest heights at which observations were recorded were:—Trappes, 9800 m., temperature −40° (on ground 17° 5); Berlin (July 31), 13,040 m., temperature −48° (on ground 15°·1). Drs. Berson and Suring reached an altitude of 10,300 m., temperature −40°. At Vienna a temperature of −33° was recorded in an unmanned balloon at a height of 10,000 metres.

AN agreement has just been concluded between Marconi's International Marine Communication Co., Ltd., and Lloyd's, by which the latter agree to employ no system of wireless telegraphy other than the "Marconi" for a period of fourteen years. The agreement also provides for the immediate equipment of ten Lloyd's signalling stations, one of which is to be on the Fastnet Rock and two on the Red Sea coast, together with the taking over of some of the existing British stations, of which there are at present eight, that could be rendered serviceable to Lloyd's for mercantile signalling.

THE *Monist* for October contains the translation of a paper by Prof. Ludwig Boltzmann on the necessity of atomic theories in physics. In it the author compares the atomic theory with the second method, which seeks to represent the facts of physics by means of differential equations; the latter method he calls "mathematico-physical phenomenology." The object of the paper is to discuss the advantages arising from the retention of the atomic theory, and its claims to be studied at least in parallel with the phenomenologic method. Even if it should be possible to formulate an all-embracing theory of the world, every feature of which has the same evidence as Fourier's theory of the conduction of heat, Prof. Boltzmann thinks it is still an open question whether such a theory can be more easily reached through atomism or phenomenology. It would even be permissible to assume that several representations of the universe, each possessing the ideal traits, were possible.

A SINGLE bone of the wing, and that imperfect, may nowadays seem but poor material on which to establish a new genus of birds, but Dr. F. A. Lucas (*Proc. U.S. Mus.*, vol. xxiv. No. 1245) appears to be justified in regarding a humerus from the Miocene of Los Angeles, California, as representing a large extinct type of flightless auk. For this the name *Mancalla californiensis* is suggested; it is considered to have equalled the great auk in size, but to have been more nearly allied to the guillemot. The existence of a flightless member of the group at such a comparatively early epoch is considered remarkable. In the same journal Messrs. Jordan and Snyder continue their review of the fishes of Japan, dealing in No. 1241 with the hypostomid and lophobranchiate types, and in No. 1244 with the gobies, of which no less than twenty-one species are described as new. No. 1242 of the journal in question contains Mr. R. V. Chamberlin's account of myriopods of the Lithobius group, while No. 1243 is devoted to the description of new flies from Southern Africa, by Mr. D. M. Coquillett.

THE development of the typical flies (Muscidæ) forms the subject of an elaborate investigation by Herr W. Noack, the results of which are published in the latest issue of the *Zeitschrift f. Wissenschaft. Zoologie* (vol. lxx. part i.). No less than eight distinct stages in developmental history are recognised. In another article in the same issue Herr J. Schaffer, of Vienna, commences a dissertation on the histology and development of cartilaginous structure, and the various modifications assumed by that substance.

SOME time ago Dr. D. G. Elliot's "Synopsis of North American Mammals" (*Field Museum Publications*) was noticed in our columns. The author has supplemented this with a "list" of the mammals of the same area (*Field Mus.—Zool.* vol. ii. No. 2), which contains a few names omitted from the larger work, together with some published too late for inclusion in the latter, and such emendations as have been found necessary. In the same journal (vol. iii. No. 5) Dr. Elliot describes and figures the reindeer, or caribou, of the Kenai Peninsula, Alaska—the *Rangifer stonei* of Dr. J. Allen—in the course of which he throws doubts on the distinctness of this form, and suggests that the American reindeer have been too much subdivided by recent writers.

IN accordance with a recent decision of the council, the first part has been issued of "Obituary Notices of Fellows of the Royal Society." It contains the biographies of recently deceased Fellows, reprinted from the year books for 1900 and 1901, together with an index to the obituary notices previously published in the Society's *Proceedings*.

IN their new catalogue, Messrs. C. Baker, of High Holborn, announce that they have arranged a series of free demonstrations during the coming session, illustrating the use of apparatus for the illumination of microscopic objects, testing of objectives, micrometry and drawing with the microscope. Another announcement of some interest refers to the microscopic slide-lending department, which has now been placed in the hands of various specialists, who have prepared type-written descriptions of most of the series of objects sent out; these should considerably increase the educational value of the system. Of other items we may cite a new engineering microscope (for examining metals) and a mosquito-collecting outfit (for malarial observations), as illustrating the large variety of apparatus now supplied to meet the requirements of modern specialisation.

HANN'S "Lehrbuch der Meteorologie" (Tauchnitz) is now complete. It consists of 10 Lieferungen instead of 8, as was originally proposed.

A PRACTICAL journal for amateur gardeners has just made its appearance under the title of *Garden Life*. The journal informs horticulturists what to do and how to do it, but it mostly leaves the reasons for the operations out of consideration. We suggest that there is a science as well as an art of horticulture, and that descriptions of simple experiments in the physiology of plants, or studies of plant diseases, might be included in the contents of future numbers.

SOME specimen copies of the *Boletim mensal* of the Observatory of Rio de Janeiro have been forwarded to us by the director. These bulletins contain useful meteorological *résumés* collected from various sources in Brazil for a series of years, and tables of the observations made several times daily at the Observatory. There are also occasional climatological sketches referring to other parts of the world.

THE September issue of *The Scientific Roll* (Bacteria) has reached us, and contains a mass of references to books and papers dealing with bacteriology. An editorial note states that although the list is fuller than any other published, it still has many omissions, and bacteriologists who find in it no mention of their contributions are reminded that the remedy is in their own hands, and are invited to send to the conductor the titles and other particulars of the books and articles they have published, that the same may be noted.

THAT well-produced periodical the *Reliquary and Illustrated Archaeologist* always contains some articles of scientific interest, and the issue for October is no exception to the rule. Mr. John Ward, of the Cardiff Museum, describes the interesting "Five Wells Tumulus" in Derbyshire, and another article of note is that by Mr. W. J. Winteberg, dealing with "Drills and Drilling Methods of the Canadian Indians." Both papers are suitably illustrated.

THE additions to the Zoological Society's Gardens during the past week include a Tantalus Monkey (*Cercopithecus tantalus*) from Africa, presented by Sergeant T. Golding; a White-throated Capuchin (*Cebus hypoleucus*) from Central America, presented by Mr. C. E. Engelbach; a Kinkajou (*Cercoleptes caudivolvulus*) from South America, presented by Mr. W. B. Hall; a Suricate (*Suricata tetradactyla*) from South Africa, presented by Mrs. Lester; two Indian Crows (*Corvus splendens*) from India, presented by Mr. Boyek; a Macaque Monkey (*Macacus cynomolgus*) from India, a Parry's Kangaroo (*Macropus parryi*, ♀), four Musky Lorikeets (*Glossopsittacus concinnus*), a Turquoisine Parrakeet (*Neophema pulchella*) from Australia, deposited; a Gouldian Grass Finch (*Poëphila gouldiae*), a Beautiful Grass Finch (*Poëphila mirabilis*) from Australia, purchased.

OUR ASTRONOMICAL COLUMN.

THE SPECTROSCOPIC BINARY η PEGASI.—Observations of this interesting spectroscopic binary, discovered by means of the Mills spectrograph in August, 1898, have now extended over more than two complete periods, and Prof. Campbell has recently issued the data obtained from the reduction of the measures. Twenty-nine photographs, extending from 1896 August 27 to 1901 May 9, have been utilised in the determination of the orbit.

Elements of Orbit, η Pegasi.

K	= 14·20 km. ± 0·13 km.
e	= 0·1548 ± 0·0106.
ω	= 5°·605 ± 3°·708.
μ	= 0·007681 rad. ± 0·000020 rad.
	= 0°·44009 ± 0°·00117.
T	= 1898 June 29·7 ± 8·1 days.
	= 1901 September 25·7.
V_0	= + 4·31 km. ± 0·10 km.
U	= 818·0 days ± 2·2 days.
$a \sin i$	= 157,800,000.

A light curve embodying the above is given, from which it is found that the maximum velocity is +20·70 km. per second, and the minimum −7.70 km. per second.

The star has been carefully examined with the 36-inch refractor, but no indication of the companion star is to be seen (*Lick Observatory Bulletin*, No. 5).

THE HAMBURG MEETING OF THE GERMAN ASSOCIATION.

THE seventy-third meeting of the German Association of Naturalists and Medical Men lately held at Hamburg was an unusually successful gathering. It will be remembered that it was the existence of this institution which suggested the foundation of our British Association, the latter being only a few years junior to the former. Though otherwise alike, the two associations nevertheless differ in some important respects, especially in the fact that the German body still unites with its purely scientific work functions performed here by the British Medical Association. Another notable difference lies in the fact that presidential addresses, which form so important a feature with us, are not delivered at the German congress. There are, moreover, no popular lectures of any kind, and it is understood that no one shall attend sectional meetings who is not professionally interested in the matters discussed. A good attendance of men of science is further promoted by the fact that it is the custom of some of the learned societies of Germany to hold their annual meetings in connection with this congress.

The meeting just concluded was formally opened on Monday, September 22, in the great Concerthaus, under the presidency of Prof. Richard Hertwig (Munich). On behalf of the municipality of Hamburg, speeches of welcome were delivered by Prof. Voller, Dr. Hartmann and Prof. von Neumayer, to which the president responded. After these proceedings Prof. Lecher (Prag) delivered an address on the discoveries of Hertz and their subsequent developments, reminding the audience that Hertz was a Hamburg man and that his work was most appropriately taken for the first consideration of the congress. A lecture from Prof. Hoffmeister was to have followed, but illness prevented him from attending. Prof. Boveri (Würzburg) then lectured on the problem of fertilisation, giving a lucid account of the phenomena in a considerable number of organisms, and concluding with an emphatic pronouncement that fertilisation in its essence must not be regarded as the cause of the development of the ovum, but rather as a means whereby certain organisms are enabled to combine in one body the characters of distinct individuals.

The congress then broke up into sections, of which eleven were devoted to the natural sciences and sixteen to medical subjects, physiology being included with the latter. Prof. van 't Hoff acted as president of the scientific, and Prof. Naunyn as president of the medical groups respectively. The division of the scientific subjects differs somewhat from that followed with us, the sections being constituted thus:—Mathematics, Physics, Applied Mathematics, Chemistry, Applied Chemistry, Physical Geography, Geography, Geology with Mineralogy, Botany, Zoology, Anthropology. For the consideration of these sections some hundreds of papers were provided.

On Wednesday the congress met in a second general session to hear a group of papers on recent developments of the atomic theory, namely, Prof. Kaufmann (Göttingen), on the development of the conception of electrons; Prof. Geitel (Wolfenbüttel) on the bearing of the theory of gas-ions on the phenomena of atmospheric electricity; Prof. Paul (Tübingen), the significance of the theory of ions in physiological chemistry; Prof. His, jun. (Leipzig), the significance of the theory of ions in clinical medicine. On the following day the medical group combined in a general meeting to receive an address from Prof. Ehrlich, of Frankfurt-a-M., on the protective substances of the blood. Prof. Gruber (Vienna), who was to have lectured on the same subject, was unavoidably absent. On the same morning a joint meeting of the scientific group assembled with Prof. van 't Hoff in the chair. The first paper was by Prof. Ostwald (Leipzig) on catalysis, giving an account of his hypothesis, or as he preferred to call it "protothesis," regarding the mode of action of catalysers, accompanied by some beautiful demonstrations. This was followed by a group of papers relating to the present position of the doctrine of organic descent. Prof. de Vries, of Amsterdam, opened with a discourse on the action of mutations and mutation-periods in the origin of species. He gave an account of his lately published experiments with *Œnothera Lamarckiana*, showing how this single species is annually splitting up into some seven constant forms which he regards as distinct species. He proceeded to suggest lines on which an attempt might be made to compute the whole number of mutations which have gone to the formation of an existing species. He was followed by Prof. Koken (Tübingen), on palæontology and the theory of

descent, and Prof. Ziegler (Jena), on the present position of this theory in zoology.

On Friday another general meeting of the whole congress was addressed by Prof. Curschmann (Leipzig), on medical science in connection with the shipping industry; by Prof. Nernst (Göttingen), on the use of electrical theories and methods in chemistry; and by Prof. Reinke (Kiel), on the natural forces at work in organisms.

Several important joint meetings of two or more sections also took place, notably of the biological sections, to discuss the position of biological teaching in schools, the subject being opened by Dr. Ahlborn, of Hamburg. In this discussion Profs. Reinke, Waldeyer, Heincke, R. Hertwig, Chun and others took part, and a committee was formed to consider the matter further. The same sections also were addressed by Prof. R. Hertwig, on the cell theory, Prof. Reinke, on cells without nuclei, and by Prof. Correns, of Tübingen, on recent discoveries in hybridisation and their bearing on theories of heredity. In connection with the latter paper the author exhibited a remarkable series of specimens illustrating the Mendelian laws of heredity. Joint meetings of the physical and chemical sections also took place to hear papers by Profs. Schilling (Göttingen), Charlier (Lund), Halm (Edinburgh), Simon (Frankfurt), Geitel (Wolfenbüttel), Abegg (Breslau), Hantsch (Würzburg), Wegscheider (Vienna), and many others. The medical and physiological sections had a no less extensive programme, a special feature being a joint meeting in the Concerthaus to receive an address by Prof. Kronecker (Berne) on the innervation of the mammalian heart.

Other meetings of considerable importance were those of the Tuberculosis Committee, under the chairmanship of Prof. Hueppe (Prag). Among the long series of papers read may be mentioned a communication by Dr. Grünbaum, of Liverpool, made on behalf of Prof. Boyce and himself, to the effect that positive evidence had been obtained by them that bovine tuberculosis could be communicated to the chimpanzee.

Besides the meetings and demonstrations some interesting exhibitions had been organised, amongst others displays of chemical, physical and surgical apparatus, a series of demonstrations of Röntgen-ray apparatus, of the methods of colour-photography, &c. The museums and other scientific and medical institutions of Hamburg were open throughout the week to members of the congress. As of special interest to naturalists may be named the novel preparations of Dr. Michaelsen, showing by means of artificial spirit-aquariums the modes of life of molluscs, worms and other marine organisms. In the Zoological Garden were exhibited the skeleton and stuffed skin of the gigantic gorilla lately brought from the Cameroons, and bought for the Tring Museum. This specimen, which stands some 6 feet high, is believed to be the finest in Europe. On Friday a special visit was made to the new institution for preventing the introduction of agricultural pests. This is the only institute of the kind in the world excepting that in New York. In it an attempt is made to disinfect all fruit and vegetable produce coming to the port of Hamburg, and thus to check the spread of exotic pests.

Each member was presented with a guide-book and with a large quarto treatise of 600 pp. describing and illustrating the natural history of the district, its scientific institutions and resources, similar treatises on the medical and hygienic institutions being in addition presented to the medical members. Each member also received a silver medallion-badge of great artistic distinction specially designed by Herr Illies.

The festivities organised and for the most part provided by the municipality and by residents in Hamburg were on an unusually magnificent scale, far exceeding anything of the kind that had been done before, and probably these evidences of the wonderful prosperity of the great free town will be to the foreign visitor among the most lasting memories of the meeting.

On Sunday, before the congress officially began, the members were invited to see a procession of boats dressed in flowers, which rowed round the inland waters of the Ausser Alster, the entertainment concluding with fireworks on the lake. On Monday the Zoological Garden was illuminated. On Tuesday some 1300 members of the congress were received by the Burgomaster and Senate of Hamburg and entertained at supper in the princely suites of rooms composing the new Rathhaus, while the remainder were invited by the directors of the Hamburg-America line to a similar entertainment on board two of the company's largest vessels. A "Festessen" took place in the Zoological Garden on the following day, at which some 1500 dined simultaneously. On Thursday a concert was provided, followed by a ball, and on Friday the whole congress was conveyed down the river in five large steamers to Blankenese, returning after dark to see the illuminations which had been arrayed along the whole length of the Elbe. Later in the evening those who were not quite exhausted returned to the Concerthaus to take part in further proceedings of a hilarious character and to listen to speeches of farewell.

On the following day the congress broke up, some joining an excursion to Heligoland, while a larger number went on a two days' expedition to Kiel, Lübeck and other places of interest.

The organisation was brought to the highest possible point of efficiency, and most of the office work throughout the meeting was patiently supplied by volunteers. Provision for the comfort of visitors went even so far as to fill the incoming trains with maps of the town and printed information on all practical matters, and students were waiting on the platforms to find lodgings for and to direct those who might need such help. The number of those who became members for the meeting is said to have exceeded 3000, about 1000 being lady-associates. For the latter, separate entertainments of various kinds were organised on a lavish scale, to take place each day during the scientific business.

It was announced that the meeting for next year will be held at Karlsbad under the presidency of Prof. Chiari, of Prag, with Prof. Selenka and Prof. Stintzing as presidents of the scientific and medical groups, respectively.

PRIZES FOR RESEARCHES IN MEDICAL SCIENCE.

THE issue of the *British Medical Journal* for August 31 is the annual educational number, in which particulars are given as to the medical curriculum, the ways to degrees or other qualifications, and the various medical schools. This number and that of September 7 contain a few particulars as to open scholarships and prizes which are awarded for the purpose of assisting investigations in various subjects connected with medicine, or for researches actually accomplished. The assistance to scientific work given by the Royal Society and the British Medical Association is too well known to make any description of it necessary, but the following statement, abridged from our contemporary, contains mention of many prizes for research not generally known to exist, some of which confer distinction far beyond their monetary value.

The Weber-Parkes Prize is awarded by the Royal College of Physicians every third year for an essay on some subject connected with the etiology, prevention, pathology, or treatment of tuberculosis, especially with reference to pulmonary consumption in man. The prize consists of 150 guineas and a silver medal. A similar medal is also awarded to the essayist who comes next in order of merit. There was no award made in 1900.

The Jacksonian Prize of the Royal College of Surgeons is open to Fellows or members of the College. Its annual value is about 12*l*. For 1901 the subject for the prize is the diagnosis and treatment of bullet wounds of the chest.

The Astley Cooper Prize is a triennial prize of the value of 300*l*., which will be next awarded in 1904 for the best essay on the pathology of carcinoma and the distribution and frequency of occurrence of the secondary deposits, corresponding to the various primary growths. The essays must contain an account of original experiments and observations not already published, and be illustrated as far as possible by preparations and drawings.

The William F. Jenks Memorial Prize is given triennially by the College of Physicians of Philadelphia for the best essay on some announced gynæcological or obstetrical subject. It is of the value of about 100*l*. The essays are to be sent to the Chairman of the Prize Committee, from whom full particulars may be obtained. The last award was in January, 1901.

The three following prizes are given for essays on subjects connected with tropical diseases, which must be sent to the editors of the *Journal of Tropical Medicine* not later than December 7, 1901. An essay on the duration of the latency of malaria after primary infection as proved by tertian or quartan periodicity or demonstration of the parasite in the blood, for the Sivewright Prize; on the spread of plague from rat to rat and from rat to man by the rat-flea, for the Belilios Prize; and on the best method of administration of quinine as a preventive of malarial fever, for the Lady Macgregor Prize.

The Carmichael Prize is in the award of the President and Council of the Royal College of Surgeons in Ireland. It is of the value of 120*l.*, and is given for the best essay dealing with the state of the medical profession in Great Britain and Ireland.

The British Medical Association has instituted two Research Scholarships, awarded annually but capable of being continued for three years, each of the yearly value of 150*l.* These are for the encouragement of research in anatomy, physiology, pathology, bacteriology, State Medicine, clinical medicine, and clinical surgery. They are awarded by the Council of the Association on the recommendation of the Scientific Grants Committee.

The Association has also established an Ernest Hart Memorial Scholarship of the annual value of 200*l.*, the holder of which is required to devote himself to the study of some subject in the department of State Medicine. Forms of application for these scholarships may be obtained from the General Secretary of the Association.

The Grocers' Company have instituted three Medical Research Scholarships, open to all British subjects, of the annual value of 250*l.* They are intended as an encouragement to the making of exact researches into the causes and prevention of important diseases.

At Cambridge there are at least two valuable studentships in science, each of the annual value of 200*l.* and tenable for three years. One is the Balfour Studentship for original research in biology, and especially in animal morphology; and the other the John Lucas Walker Studentship for original research in pathology. At Trinity College the Coutts Trotter Studentship is open in physiology and experimental physics.

In connection with the Jenner Institute of Preventive Medicine a studentship of the value of 150*l.* has been offered. It is open to all British, including Colonial, subjects; it is tenable for one year and is renewable for a second year. It has been instituted for the purpose of research in pathological chemistry.

The Salters' Company Research Fellowship, of the annual value of 100*l.*, is for the promotion of research in pharmacology. It is awarded by the Company on the nomination of the treasurer of St. Thomas's Hospital and a Committee of Selection. It may be held for a term of three years, and the research must be prosecuted in the laboratories of St. Thomas's Hospital.

In connection with University College, Liverpool, are the Alexandra Fellowship in pathology, which was instituted in 1899 for a period of five years, and is of the annual value of 100*l.*; and the Colonial Fellowship in pathology and bacteriology, for which there is a preference for members of Colonial universities and medical schools.

The Walker Prize of the Royal College of Surgeons is awarded every five years for the best work in advancing the knowledge of the pathology and therapeutics of cancer. It is of the value of 100*l.* It is open to foreigners as well as British subjects, and it is not intended that essays should be written specially for the competition.

The John Tomes Prize is awarded triennially by the Royal College of Surgeons for original work on dental surgery, pathology, anatomy, physiology, or mechanics. The next award is for the period ending December 31, 1902.

The Cameron Prize, which is of the value of about 100*l.*, is given annually by the University of Edinburgh to the member of the medical profession who shall be adjudged to have made the most valuable addition to medical therapeutics during the year preceding.

The Marshall Hall Prize is given every five years by the Royal Medical and Chirurgical Society for physiological and pathological researches relating to the nervous system.

The Alvarenga Prize of the College of Physicians of Philadelphia, of the value of 36*l.*, is awarded annually for the best essay on any subject in medicine not already published. The essays, bearing a motto but no name, are to be sent to the secretary on or before May 1 of each year, and the award is made about July 14 following. A second is given by the Académie de Médicine in Paris, and a third by the Hufeland Society in Berlin, a fourth in Belgium, and a fifth by the Misericordia Hospital of Lisbon.

The Riberi Prize, which is of the value of 800*l.*, is offered by the Royal Medical Academy of Turin for original work in anatomy, physiology, pathology, or pharmacology. Research on the history of medicine since the Renaissance may also be submitted. The account of the research must be written in Latin, French, or Italian, and is to be sent to the secretary of the Academy. The prize is awarded for work done during the previous five years, and the last award was made in 1897.

The Bressa Prize of the Royal Academy of Science, Turin, is of the value of about 400*l.*, and is given for the most important scientific work produced during a given term of years. The last award was made in 1899.

The Vallauri Prize, of the value of 1,200*l.*, is in the gift of the Royal Academy of Sciences of Turin, and will be awarded to the scientific investigator, Italian or foreign, who within the period of four years from January 1, 1899, to December 31, 1902, shall be considered to have published the most noteworthy work on any of the physical sciences, taking that term in its widest sense.

One of the Nobel Prizes is awarded by the Carolinian Institute in Stockholm to the person who has been adjudged to have made the most important discovery in physiology or medicine during the preceding year. Recently two prizes, each of the value of about 11,000*l.* sterling, have been awarded by the Nobel Institute, one to Prof. Finsen, the founder of the Medical Light Institute at Copenhagen, and the other to Prof. Pawlow, of St. Petersburg, for his researches in regard to nutrition.

About thirty open prizes are offered each year by the Académie de Médecine of Paris, of which the most valuable is the François-Joseph Audiffred Prize. This is of the value of 1,000*l.*, and is offered to any person, without distinction of nationality or profession, who in the opinion of the Académie de Médecine is rightly adjudged to have discovered a preventive or cure of tuberculosis. The following are also among the more important offered for the year ending with the end of February, 1902; the sum specified in each case does not necessarily go to one candidate, but may be divided. The Academy Prize, awarded annually, worth about 40*l.*, is this year for a research on the *rôle* of toxins in pathology; the Baillarger Prize, of about 80*l.* (biennial), is for the best work on the treatment of mental diseases and the organisation of asylums; and the Charles Boullard Prize, also biennial, of 50*l.*, is for a similar subject. The Barbier Prize, of 80*l.* (biennial), is for the discovery of a cure for such "incurable" maladies as hydrophobia, cancer, epilepsy, typhoid and cholera. The Mathieu Bourceret Prize, of 50*l.* (annual), is for work on the circulation of the blood. The Campbell Dupierris Prize (biennial), of the value of 96*l.*, is for the best work on anæsthesia or the diseases of the urinary passages. The Chevillon Prize (annual), of 65*l.*, is for the best work on the treatment of cancer. The Desportes Prize, of 55*l.* (annual), will be awarded for the best work on practical medical therapeutics. The Herpin (of Metz) Prize (quadrennial), of 50*l.*, is offered for a research on the abortive treatment of tetanus. The Theodore Herpin (of Geneva) Prize, of 125*l.* (annual), is for a research on epilepsy and nervous diseases. The Laborie Prize, of 210*l.* (annual), is given for the greatest advancement in surgical science during the year. The Lefèvre Prize (triennial), of 75*l.*, is for a research on melancholia. The Meynot Prize (annual), of 108*l.*, is for the best work on ear disease; and the Saintour Prize (biennial), of 166*l.*, for the best work on any subject in medicine.

CHEMISTRY AT THE BRITISH ASSOCIATION.

IN spite of the fact that a number of papers of general interest were contributed to Section B at the Glasgow meeting, the attendance was not so good as at the Bradford meeting last year. After the reading of the presidential address, a paper was read on duty-free alcohol by Dr. W. T. Lawrence, in which it was advocated that the Government should permit the use of non-methylated alcohol which had not paid duty for scientific purposes. In the course of the ensuing discussion, Dr. T. E. Thorpe drew attention to some of the difficulties with which the Excise Department would have to cope if such a course were permitted, and Prof. A. Michael, of Boston, stated that the United States Government allowed the use of non-methylated duty-free alcohol for scientific purposes and did not seem to meet with administrative difficulties. Dr. A. G. Green presented a comprehensive statistical report on the coal-tar industry, in which the progress made in this industry in Germany during recent years was strongly contrasted with its decadence in this country. The report of the Committee on preparing a new series of wave-length tables of the spectra of the elements was presented. Prof. Adrian Brown contributed a paper on enzymic

action, in which he quoted the experimental results of an investigation of the action of invertase on cane sugar; these results confirm the conclusion of previous workers that the action of inversion does not follow the simple law of mass action, but the author does not regard the action as independent of mass influence. He considers that the influence of mass in inversion changes is restricted by some other and hitherto unrecognised influence, and this he believes he has found in the time factor of molecular change. In reply to remarks by Prof. Reynolds Green, the author stated that his results were not necessarily in disaccord with those of Croft Hill. A paper was read by Prof. E. A. Letts and Mr. R. F. Blake, on the chemical and biological changes occurring during the treatment of sewage by the so-called bacteria beds. A large portion of the unoxidised nitrogen present in sewage disappears during the passage of the sewage through the so-called bacteria beds, and the authors consider that this may be due either to escape of the nitrogen in the gaseous state as free nitrogen or possibly as oxides or to the passage of the nitrogen into the tissues of animals or vegetables; both of these causes of loss may operate at the same time. An examination of sewage matter before and after passage through the beds showed that in nearly all cases the amount of dissolved nitrogen present in the sewage was greater after treatment than before, although, of course, if free nitrogen were evolved, only a minute fraction of it would remain dissolved in the sewage effluent. With respect to the possible biological explanation of the loss, it is pointed out that the sewage beds at Belfast and other places swarm with minute insects (*Podura aquatica*), and that species of worms are also present; these in feeding on the sewage undoubtedly cause a loss of nitrogen. A paper was then read by Dr. S. Rideal on humus and the so-called irreducible residue in bacterial treatment of sewage, in which the results were detailed of a number of analyses of the humus-like substance or so-called irreducible residue produced in bacterial sewage beds. It is shown that in this material the ratio of carbon to nitrogen and the percentage of nitrogen in the organic matter present are very nearly the same as in humus mould; the conclusion is drawn that if sewage has undergone proper bacterial fermentation the small quantity of peaty deposit formed is of the nature of humus and is practically inoffensive. In a paper on sulphuric acid as a typhoid disinfectant, Dr. S. Rideal advocated the use of sulphuric acid, either as such or in a more portable form as sodium bisulphate, for destroying the *Bacillus typhosus* in potable waters or in drainage from isolation hospitals. Mr. W. Ackroyd gave a paper on the inverse ratio of chlorine to rainfall, in which it was shown that when the observation periods are shortened to daily estimations of the chlorine, minimal amounts of rainfall are marked by maximum contents of chlorine, and *vice versâ*. In a second paper, Mr. Ackroyd dealt with the distribution of chlorine in Yorkshire. Mr. G. T. Beilby, in a paper on the minute structure of metals, showed that the microscopic examination of metallic surfaces has revealed that metals occur in two forms, viz., as minute scales or "spicules" (*a*) and as a transparent glass-like substance (*b*). The spicules do not vary much in size in the different metals and have a diameter of 1/300 to 1/400 of a millimetre; the form *a* passes into the form *b* when the metal is pressed or hammered, and all polished metallic surfaces are covered with a thin layer of this transparent form as with a lacquer or enamel. Prof. G. G. Henderson and Mr. G. T. Beilby read a paper on the action of ammonia on metals at high temperatures; on exposing platinum, copper, gold, silver, iron, nickel and cobalt to ammonia gas at 600° to 900° disintegration of the metal occurs, whilst a large proportion of the ammonia is decomposed into its elements. After the treatment the metal shows a spongy or cellular structure, as if it had been rapidly cooled whilst in a state of effervescence; copper and iron rods of a quarter of an inch diameter are penetrated to the centre by the ammonia gas within half an hour, and copper exposed to the action of ammonia gas for seven days at 800° falls to a fine powder. Dr. W. C. Anderson and Mr. G. Lean gave a paper on aluminium-tin alloys, in which they show that these alloys evolve hydrogen freely when placed in water; the microscopic examination of the water-corroded plates of alloy indicates that contact action between the excess of tin and the aluminium-tin compound is responsible for the spontaneous oxidation. Prof. Willy Marckwald, of Berlin, gave a very interesting demonstration and description of the properties of radium; he had surmised, from the work of P. and S. Curie, that the barium salt extracted from pitchblende contains the radium salt as an isomorphous constituent, and that the process used by these workers for separating a strongly radio-active salt from the barium compound is probably similar to that in use for isolating the constituents of an isomorphous mixture. He therefore fractionally crystallised the barium chloride prepared from pitchblende from water, and found that pure barium chloride first separates and then a material, probably the eutectic mixture, which is very rich in the radio-active component. The most strongly radio-active fractions have the power of immediately discharging a charged gold leaf electroscope when at the distance of half a metre from the latter and when preserved under colourless glass soon turn it a deep brown colour. The radio-active substance is strongly luminescent in a dark room, and on interposing the hand between the preparation and a barium platino-cyanide screen, the bones in the fingers are seen sharply delineated on the screen. Prof. Marckwald also exhibited several preparations of so-called "phototropic" substances, compounds which change colour on exposure to sunlight and recover their original tint on preservation in a dark place; he mentioned that the rapidity of change in either direction is considerably influenced by the temperature. Prof. A. Michael, of Boston, read papers on the genesis of matter and on the process of substitution; he also contributed a paper on the three stereoisomeric cinnamic acids, in which he claimed to have proved that these three isomerides actually exist, that is, that one more isomeride exists than can be accounted for by the van 't Hoff hypothesis as interpreted by Wislicenus. Prof. G. G. Henderson and Mr. Corstorphine read a paper on the condensation of benzil with dibenzylketone; in this condensation a tetraphenylcyclopentenolone is produced, and on heating it with red phosphorus and hydriodic acid a mixture of tetraphenylcyclopentene and tetraphenylcyclopentane is formed. Dr. Hodgkinson and Mr. L. Limpach contributed a paper on some relations between physical constants and constitution in benzenoid amines, and Dr. G. Young gave a paper on the existence of certain semicarbazides in more than one modification. Prof. W. H. Perkin, jun., gave a brief outline of his work on the synthetical formation of bridged rings. Prof. Joji Sakurai, of Tokio, in a paper on some points in chemical education, observed that in spite of the rapid progress made in chemistry during the past fifteen years, chemical education seemed still to be carried out in an inefficient and unsatisfactory manner. He pleaded for the more extensive use of physical chemistry as an educational agent, but wished to replace the ordinary name of this branch of the subject by the more rational one of general chemistry. Mr. W. Thomson contributed a paper on the detection and estimation of arsenic in beer and articles of food; after noting that arsenic is introduced into barley during the process of malting owing to the employment of anthracite coal or coke containing arsenic, he suggested that all beers in 50 c.c. of which arsenic could be detected by any test whatever should be condemned. In a report entitled "The Equilibrium Law as Applied to Salt Separation and to the Formation of Oceanic Salt Deposits," Dr. E. F. Armstrong gave an excellent *résumé* of the work of van 't Hoff and his pupils on the investigation of the conditions attending the formation of the German deposits of magnesium salts; the report was illustrated by the aid of a number of models. Dr. J. Gibson, in a paper on the electrolytic conductivity of halogen acid solutions, detailed the results of experiments which showed that halogen acid solutions of concentrations corresponding to a change of curvature of the electrolytic conductivity curve have altogether peculiar properties. Other papers were read by Mr. P. J. Hartog, on the flame coloration and spectrum of the nickel compounds, by Dr. Farmer, on the methods of determining the hydrolytic dissociation of salts, and by Dr. T. S. Patterson, on the influence of solvents on the rotation of optically active compounds.

ENGINEERING AT THE BRITISH ASSOCIATION.

SECTION G suffered badly at Glasgow, both in attendance and in the quality of the papers presented to it, from the Engineering Congress which was held in the University buildings during the preceding week; many regular members of the Section were absent, and several valuable papers which would under ordinary circumstances have come to the Section were read instead at one or other of the Congress sectional meetings. On the opening day, after the presidential address,

since the engineering departments of the Glasgow International Exhibition would naturally be frequently visited by members of the Section, it was arranged to have a paper descriptive of the mechanical exhibits; this was given by Mr. D. H. Morton, and proved most useful in assisting visitors to spend to the best advantage the hours they gave up to the Exhibition. The author, rightly enough, deplored the almost complete absence of any marine engineering exhibits and the poor show of locomotives; but he pointed out that in another of the great industries of Glasgow, steel making, there was a remarkably complete and most instructive series of exhibits, the enormous steel plates and huge steel forgings and castings being especially interesting. On the same day two interesting papers by Mr. J. R. Wigham, on a long-continuous-burning petroleum lamp for beacons and buoys, and on a new scintillating lighthouse light, were also read. In the first paper the author claimed that by burning petroleum and using the wick horizontally, so that the flame sprang from the side and not from the edge or ends, a steady light could be secured requiring no attention for a month; the slow continuous movement of the wick over the roller was secured by an ingenious arrangement in which the gradual escape of oil from a cylinder caused a float attached to the wick end to slowly descend, thus causing the wick to travel over the roller and so present a new surface to the flame. Examples of both these appliances were on show in the University buildings.

Another paper on this day was a short note by Mr. J. E. Petavel, in which he described a recording manometer he had devised, for obtaining a record of the high pressures reached by exploding charges of gas in closed cylinders. The instrument seemed well adapted for its purpose and ought to prove useful in gas and petroleum engine work.

Two reports were presented to the Section, one by the Small Screw Gauge Committee, in which the extreme trouble they had met with in obtaining accurate gauges was again described, and as a result practically little progress had been made since the last report was presented at Bradford; the other by the Committee on Resistance of Road Vehicles to Traction. This committee, which was appointed at Bradford, has discovered that the task it has embarked upon is a most difficult one, and one which will involve an expenditure far beyond any grants which could be given by the Association. The committee therefore sought and obtained authority to approach other bodies for financial help—many promises of substantial assistance had been given before the meeting. The work done up to date is briefly as follows:—(*a*) a dynamometer has been designed and is in course of construction; (*b*) a motor (lent by a member of the committee) is being fitted up to carry the dynamometer and is having a new and more powerful engine fitted to it; (*c*) it has been decided after careful consideration to begin the experiments by testing single wheels with various types of tyres, on artificial tracks, and then later on, with the experience gained in these preliminary investigations, the work on actual vehicles on ordinary roads will probably be much simplified. As some misapprehension exists as to the work the committee are attempting to carry out, it may be as well to state that it is work of the utmost value to the country, and work of a highly scientific character. No recent experiments have been carried out on this most important question, and designers of motor vehicles are obliged either to adopt rule of thumb methods or to fall back on data obtained by experiments made many years ago, on roads of quite different construction to those now in use, and with only one type of tyre, the solid steel or iron one. Should the committee succeed in the elaborate series of experiments they have planned, not only will designers of self-propelled vehicles have constants and data available for their use, upon which they can place absolute reliance, but road engineers will have exact information on two questions of the greatest interest to them, the effect of the method of moving a vehicle (that is, whether hauled of self-propelled) upon the life of a road, and secondly, the relative advantages of the different materials now in use for road making in regard to the frictional resistances encountered by the vehicles moving over them.

As the president of the Section devoted a part of his address to the modern development of passenger and goods traffic, it was natural that many of the papers read before the Section should deal directly or indirectly with this subject. Mr. N. D. Macdonald, in a paper on railway rolling stock present and future, attacked in vigorous fashion railway management in this country; he undoubtedly put his finger on many weak spots, notably as regards brakes and our old-fashioned goods trucks, but, like most amateurs when dealing with professional subjects, he spoilt much of his case by exaggeration. Professional engineers, like every other class of men, are liable to errors. They are prone to prefer old-fashioned methods and are too little inclined to take up and try novelties, but, after all, they are men of understanding and business men, and they are not likely to shut their eyes to improvements going on in other countries or to refuse to adopt them simply because foreigners first tried them. No one who travels much can fail to note the great improvements in railway management in this country during the past ten years, or the many changes still to be made if we are to keep abreast of the latest advances; but, after all, it is wiser to adopt radical changes cautiously, and we fancy the public will continue to place more reliance on the judgment of the trained expert than of the over-eager amateur.

Mr. Bunau-Varilla, formerly engineer-in-chief of the Panama Canal, in a paper on the canal, vigorously defended the judgment of those who selected that site for the canal instead of the Nicaragua route. The author gave many strong reasons for his preference for Panama; in particular he contrasted the almost entire freedom of the Panama site from seismic disturbances with the constant and ever-present danger to all concrete and masonry work all along the Nicaragua route from such causes. The case for Panama was so strongly put that it was unfortunate there was no real discussion on the paper, and therefore the arguments in favour of Nicaragua were not given a chance.

In electrical engineering, only two papers of much interest were presented, a valuable one by Prof. E. Wilson, on the commercial importance of aluminium, and a paper by Mr. Killingworth Hedges, on the protection of buildings from lightning. Prof. Wilson, after a brief description of the latest methods of manufacture, devoted himself mainly to an account of the use of aluminium as a conductor of electricity and its advantages for this purpose. In the discussion, the president (Colonel Crompton) referred to the great difficulty in securing uniform quality in aluminium tubes and sheets, and suggested that this stumbling-block must be removed if the extended uses of the metal which engineers hoped for were to become possible. Mr. K. Hedges drew attention to the work of the committee of British architects which was now engaged in considering the question of the protection of buildings from lightning effects, and to the urgent need of the adoption of some uniform system. He described in detail his re-arrangement of the system in use at St. Paul's Cathedral in London, where the conductors put up in 1872 were found to be quite useless for the purpose they were intended to serve. He had increased the number of ordinary conductors from air to earth, and, in addition, ran horizontal cables on the ridges of the roofs and in other prominent positions, thus encircling the building. These were connected to the vertical conductors wherever they crossed, and were also furnished at intervals with aigrettes or spikes, invisible from the ground level, thus giving many points of discharge. The author drew attention to the unsuitability of soldered joints for conductors, and described his own special joint box; he also explained the tubular earth he designed to get over the difficulties brought about by the old foundations of the cathedral interfering with the use of an ordinary earth plate. In the more purely mechanical side of its work, the Section dealt with two papers of much interest. Prof. George Forbes described his "folding rangefinder for infantry," and Mr. M. Barr the machines he had designed for the manufacture of type. Prof. Forbes' instrument is of the class known as "one-man portable-base range-finders," and possesses great accuracy up to a range of 3000 yards. It was founded on Adie's original instrument. It consists of a folding aluminium base of square tube, hinged at the centre, and a field glass. At each end of the base when opened out is a doubly reflecting prism, the rays of light from any object are reflected at each of these end prisms along each half tube, and then again at the centre into the two telescopes of the binocular glass, the final directions of the rays being parallel to the original. The angle between these rays is measured by means of two vertical wires, one in each telescope, one wire is fixed, and the other can be moved by a micrometer screw until the two appear to coincide and the object appears distinctly; the distance of the object is then at once given, to within 2 per cent. in 3000 yards. The author claimed great accuracy in stereoscopic vision, but Profs. Barr and Stroud, who took part in the discussion, and drew attention to the

somewhat different lines on which they had worked in their range-finder (of which 400 are now in use in our Navy), differed on this point from him and preferred the method of single coincidence. Mr. Barr's paper, illustrated by lantern slides, was of too highly a technical nature to be dealt with in detail in the space at our disposal, suffice it to say it bids fair to revolutionise the method of carving or engraving the matrices used in type casting. The new process dispenses with wax and electro-plating processes, and secures a pattern cut out of solid brass in a much shorter time than was possible in any of the older methods. The author described the great difficulties he had met with in this work, both in the design of a strong, rigid and easily worked pantograph and in the attempt to carve out rapidly the large amount of superfluous material in the brass plate which had to be removed in order that the design should be left clearly in relief on a smooth plane; all these had now been overcome. Special machinery had been designed capable of extraordinary accuracy for cutting rapidly the punches needed, and for grinding the cutters.

The last paper we need refer to was one by Mr. C. R. Garrard on some recent developments in chain driving, which elicited a very interesting discussion, one of the best during the meeting. He gave figures as to the extraordinary pressure per square inch used in chain bearings as compared with those adopted in ordinary engineering work; in an ordinary bicycle chain as high a figure as 11,765 pounds per square inch may be occasionally reached; an account was given of the most recent methods of making these chains and of the quality of steel used, and, lastly, of the use of chains for high-speed driving purposes.

Apparently for the reason given before, local engineers took but little interest or share in the proceedings of the Section, and on the whole it was a disappointing meeting, both from the point of view of attendance and discussion on the papers and also in the quality and general value of the papers dealt with. Section G still calls in vain for papers from the numerous engineering laboratories throughout the kingdom; there are scores of young engineers, engaged in scientific research work, and until they can be got hold of, and the class of papers radically altered, Section G will fail to appeal to the great body of engineers in the country. T. H. B.

ANTHROPOLOGY AT THE BRITISH ASSOCIATION.

THE Anthropological Section of the British Association met in the new Anatomy Department of the Glasgow University, which was formally opened by Lord Lister on the first afternoon of the meeting. The address of the president of the Section, Prof. D. J. Cunningham, F.R.S., dealt with the human brain, and the part which it has played in the evolution of man, and is to be found in full in NATURE of September 26, p. 539. The rest of the programme was planned as follows: Thursday morning and Monday afternoon were devoted to physical anthropology, which was represented by an unusual number of highly specialist papers; Tuesday to ethnography, chiefly American and Malayan; Friday and Monday morning to archæology; and Wednesday to anthropometry and folklore. The principal papers are classified below in order of their subject-matter.

Anthropography.

Prof. J. Cleland, F.R.S., gave a demonstration of the cartilage of the external ear in the monotremata in relation to the human ear, illustrated from *Echidna* and *Ornithorhynchus*.

Dr. J. F. Gemmill illustrated, by a series of fine microscope-projections, the origin of the cartilage of the *stapes* and its continuity with the hyoid arch, showing that the *stapes* is developed independently of the periotic capsule, and belongs to the hyoid bar.

Prof. A. Macalister, F.R.S., contributed notes on the morphology of transverse vertebral processes, with the object of determining embryologically the morphological relations of the several parts of the neural arch. A further note on the third occipital condyle showed that two distinct structures are comprised under this name—a mesial ossification in the sheath of the notochord, and a lateral and usually paired process caused by the deficiency of the mesial part of the hypochordal element of the hindmost occipital vertebra, with thickening of the lateral portion of the arch.

Principal Mackay read a paper on suprasternal bones in the human subject, which gave rise to an animated discussion of the embryological evidence.

Prof. J. Symington combated Hochstetter's view that the "temporary fissures" of the human cerebral hemispheres are merely the product of incipient maceration and putrefaction in laboratory specimens. He admitted, however, that the arcuate fissure is of no morphological significance, and that it has nothing to do with the hippocampal fissure, which latter can be traced in the fœtal brain in the position which it occupies throughout life in the monotremata and marsupialia. The rudimentary grey and white matter on the back of the adult human *corpus callosum* is probably the remains of a hippocampal formation.

Mr. J. F. Tocher and Mr. J. Gray discussed the frequency and pigmentation value of the surnames of Scottish school-children in East Aberdeenshire. There is a presumption that the present possessors of surnames inherit some of the physical characteristics of their ancestors of the thirteenth and fourteenth centuries, when hereditary surnames first became common in Scotland, and this is confirmed by the fact that among 751 surnames noted, 63 Highland names covered 13 to 14 per cent. of the population; the same proportion of Highland blood as had been previously ascertained by measurements. There is wide variability in the pigmentation value of different surnames; Frasers, for example (from blonde Inverness-shire), tending to be blonde; and Robertsons and Gordons (from Perthshire and West Aberdeenshire) to be dark. A committee of the Association was appointed to assist Messrs. Gray and Tocher in organising a similar pigmentation-survey for the school-children of the rest of Scotland.

Miss Nina Layard exhibited a skull found in peat in the bed of the river Orwell, now in the museum of the College of Surgeons. It proved to be of the same pre-Roman British type which is common in the Fen district.

Mr. W. M. Douglas, superintendent of police, described the working of the Bertillon method of personal identification, as practised in Glasgow. In discussion, Dr. Garson laid stress on the value of the form of nose and ear in identification, as against the colour of hair and eye; pronouncing photographs useless, but finger prints most important.

Ethnography.

The Report of the Ethnographic Survey of Canada summarised the work of the year, and introduced a copious memorandum by Mr. C. Hill Tout on the natives of British Columbia. The committee was reappointed with a grant of 15*l*. Mr. J. O. Brant Sero, a Canadian Mohawk, gave an account of the traditional history of the Caniengahakas and their culture-hero Dekanawideh, with notes on their social and political organisation. This striking communication is printed in full in *Man* for November.

Mr. Hesketh Prichard described in detail the manners and customs of the Tehuelche Indians of Patagonia, and Mr. Seymour Hawtrey those of the Lengua Indians of the Gran Chaco.

The Report of the Skeat Expedition to the Malay Peninsula contained an elaborate account of Malay industries, and was illustrated by photographs and reproductions of native implements and fabrics. Mr. Skeat contributed a detailed study of the Sakais and Samangs, wild tribes in the interior of the Peninsula who retain many marks of a primitive stage of culture.

Messrs. Annandale and Robinson, who are still in the field, sent a full account of the half-Siamese half-Malay community of Sai-Kau in the northerly border-state of Nawnchik, in which the two peoples live side by side and have given rise to a mixed type of culture. Physical measurements show the survival in both of a marked Negrito element.

Mr. R. Shelford propounded a provisional classification of the swords of the tribes of Sarawak.

Dr. W. H. R. Rivers discussed the functions of the maternal-uncle, son-in-law and brother-in-law in Torres Straits, with the view of illustrating the underlying principles and the practical working of certain phases of primitive society.

Mr. C. S. Myers analysed the emotional life of the inhabitants of Murray Island, which he studied in the course of the Cambridge expedition to Torres Strait. The excitability of the native is due rather to the varying sanctions of society than to distinctive mental constitution.

Mr. W. Crooke described the organisation of the projected Ethnographic Survey of India and offered criticisms in detail, regretting, in particular, that it had not been found possible to

provide for systematic photography of native types, occupations and ceremonies.

Mr. R. A. S. Macalister gave an account of the customs, ceremonies and beliefs of the Fellahin of Western Palestine.

Mr. D. MacRitchie, under the title "Hints of Evolution in Tradition," discussed the value of the widespread stories of giants, dwarfs, fairies and hairy folk as evidence of the survival of primitive types of mankind in remote localities until comparatively recent times.

Mr. J. S. Stuart Glennie criticised Dr. Frazer's views of the relations between magic, religion and science, as expressed in the second edition of the "Golden Bough." The new stage which Dr. Frazer named "science" would give a higher and more verifiable form to the common ideal and social observances which constituted religion.

Archaeology.

Dr. W. Allen Sturge opened a discussion on the chronology of the Stone Age of man, with especial reference to his co-existence with an Ice Age, laying stress on the evidence of patination as a test of relative age, and exhibiting a series of implements which appeared to show traces of reworking after a prolonged interval, and also scratches on a patinated surface, which he claimed to be due to ice-movement. In discussion, Sir John Evans pointed out that patination is not always a safe guide as to relative age; and Prof. Kendal and others held that scratches similar to those exhibited are produced by small local movements in the mass of a gravel-bed.

Mr. Coffey attacked the same question from another side by an exhibit of naturally chipped flints from the Larne gravels and North Irish beaches, which so closely resembled the chipping of the alleged "Eolithic" implements as to prevent any certain conclusion being reached as to what really is artificial chipping.

Miss Layard exhibited a flint palæolith with alleged "thong-marks," which seemed, however, to be patches of the rough skin of the nodule; and also a series of implements of stone and horn from the neighbourhood of Ipswich.

Mr. F. D. Longe exhibited a piece of yew from the forest bed near Kessingland, showing cuts made by a straight-edged instrument. Doubts were, however, expressed as to the antiquity of the cuts.

The Report on the age of stone circles gave full particulars of excavations conducted by the committee at Arbor Low. The occurrence of a Bronze Age interment-barrow *on* the rampart of the circle gave a downward limit of date for the latter, and the discovery of flint flakes and other objects *in situ* went far to determine an upward limit. Further investigation, however, is required, and the committee was reappointed with a grant of 30*l*.

An important paper on excavations on Neolithic sites in the Isle of Arran was contributed by Drs. Duncan and Bryce. The results show that the mere presence of stone implements affords no test of the archæological horizon, but that the pottery found in the "Megalithic cists serially arranged" distinguishes these as earlier than the short cists in cairns or circles, and as truly Neolithic. No traces of cremation were found; but only a few of the human remains were in a condition for examination. The cephalic indices of four individuals were 66·6, 70, 75, 75·5, and the anatomical characters were identical with those of the English "long-barrow" folk. The paper will be published in full in *Proc.* Soc. Antiq. Scot., and the anthropographic material in *Journ.* Anthr. Inst.

Dr. Munro gave an account of a "kitchen midden" excavated near Elie, in Fife, which was proved to occupy the site of a wooden house belonging to pastoral or hunting people, and to belong to the eighth century, A.D. (cf. *Proc.* Soc. Antiq. Scot. xxxiv.)

Mr. J. H. Cunningham described the excavation by the Scottish Society of Antiquaries of the Roman station at Ardoch in Perthshire; the results are published fully in *Proc.* Soc. Antiq. Scot., xxxii. Mr. Thomas Ross described the recent excavation of the Roman camp at Inchtuthill.

The Report of the Silchester Excavation Committee recorded the clearance of four fresh *insulae* (xxiii–xxvi) and the discovery of some interesting pavements, and of a large hoard of smith's tools. The Committee was reappointed with a grant of 5*l*. and a similar committee was granted to cooperate with the Cardiff Naturalists' Club in excavation at Gelligaer.

Mr. R. A. S. Macalister discussed the external evidence bearing on the age of Ogham writing in Ireland, pointing out that certain Ogham inscriptions occur in association with tumuli, circles, and alignments, on stones with non-Christian symbolism, or in other circumstances which suggest a pre-Christian origin for the Ogham script.

Mr. James Paton gave a demonstration of Scottish antiquities in the Art Gallery of the Glasgow Exhibition; an innovation which was fully justified by the result, and might be repeated elsewhere with advantage.

Mr. C. S. Myers described the bones of Hen Nekht, an Egyptian king of the third dynasty, who was of giant stature (1870 mm.), and identified him with the gigantic king recorded diversely by Manetho as penultimate king of the second dynasty, and by Eratosthenes as first king of the third.

The Report of the Cretan Exploration Committee summarised the results of excavation on Mycenæan sites at Knossos, Zakro and Præsos in the seasons 1900 and 1901. At Knossos the remains of a splendid palace have yielded a large number of fragmentary fresco paintings, many works of art in bronze, stone and pottery, and a great wealth of clay tablets inscribed in Ægean hieroglyphic and linear characters. The excavations at Knossos demand another season's work, and the Committee was reappointed, with a further grant of 100*l*.

Mr. A. J. Evans, F.R.S., supplemented the Report with a description of the Neolithic settlement which underlies the Mycenæan palace at Knossos, drawing particular attention to the stone mace heads and small human figures in clay and marble, which seemed to him to present Anatolian analogies, and to indicate intercommunication between the Ægean and Babylonia. The Neolithic culture of the Ægean presents points of strong contrast with that of the Bronze Age; and the absence as yet of spiraliform ornament confirms the opinion that this motive was introduced into the Ægean at a later date, and probably from Egypt.

Mr. Bosanquet gave a detailed account of the excavations on the site of Præsos, the ancient capital of eastern Crete. Two large sanctuaries were discovered, together with an "andreion" or public dining-hall, of Hellenistic date, and a remarkable inscription written in Greek characters of the fifth century, but composed in the Eteocretan language.

Mr. Hogarth contributed a description of a Mycenæan site excavated by him at Zakro on the east coast of Crete, with houses, tombs, much pottery of new types, and a deposit of clay impressions from Mycenæan seal-stones.

Mr. R. A. S. Macalister described the result of several seasons' excavation on small sites in western Palestine, which throw important light on the civilisation of the early Israelites and of Philistia.

Interim reports were received from the committees on anthropological photographs and on the present state of anthropological teaching. A new committee was appointed, with Prof. Macalister, F.R.S., as chairman, Mr. C. S. Myers as secretary, and a grant of 15*l*. to conduct anthropometric observations among the native troops of the Egyptian army.

BOTANY AT THE BRITISH ASSOCIATION.

AFTER the delivery of the presidential address by Prof. Bayley Balfour, F.R.S., Dr. Lotsy (Hilbersum, near Arnhem, Holland) explained to the Section the aims and proposals of the International Association of Botanists, which was founded at Geneva in August. The Association has purchased the *Botanisches Centralblatt*, which it proposes to conduct as a first-class review of current botanical literature. Dr. Lotsy pointed out that an increased number of subscribers and shareholders is desired in order to ensure success. On Saturday the members of the Section were invited by the President to the Edinburgh Royal Botanic Garden, where they inspected the museum and garden and were afterwards entertained at lunch by Prof. and Mrs. Bayley Balfour. The excellence of the museum preparations was a striking feature, particularly the specimens and dissections preserved in spirit and labelled for teaching purposes. A very useful paper was read before the Section by Mr. Tagg, in which he gave an account of the methods employed by him with conspicuous success in the Edinburgh Museum in preserving and preparing plants for museum purposes.

On Friday afternoon Prof. Reynolds Green, F.R.S., delivered a lecture on flesh-eating plants. Monday morning was devoted to a joint discussion (Botanical and Educational

Sections) on the teaching of botany, an account of which has appeared in the report of the work of the latter Section. Mr. A. G. Tansley described the vegetation of Mount Ophir and gave a lantern exhibition of several photographs which he had taken during a recent expedition to the Malay Peninsula. The views of dense masses of *Matonia pectinata*, *Dipteris conjugata* and *D. Lobbiana* growing in the Mount Ophir region were particularly striking as illustrating the present home of these isolated fern genera which played a prominent part in European vegetation during the Mesozoic epoch. Some excellent botanical photographs from the Malay Peninsula were also exhibited by Mr. Yapp, who acted for some months as botanist to the Skeat Expedition.

Thallophyta.—Cytology of the Cyanophyceæ, by Harold Wager. The researches of Scott, Zacharias, and others have definitely revealed the fact that the contents of the cells of the Cyanophyceæ are differentiated into two distinct portions, an outer peripheral layer in which the colouring matters are placed, and a central colourless portion which is usually spoken of as the "central body." The central body is regarded by many observers, and notably by Bütschli, as a true nucleus. According to the author's observations, it appears to resemble the nuclei of higher organisms, in that it is composed of a chromatic network, but it differs from them in the absence of a nuclear membrane and nucleolus. Staining and other reactions show that chromatin is present, but in most cases only in small quantities. The presence of phosphorus in the central body can also be demonstrated, as Macallum has shown, by means of the molybdate phenylhydrazine reaction. In the process of division the cell begins to divide and new cell-walls are formed independently of the division of the nucleus. In the process of nuclear division the chromatin threads become drawn out longitudinally and parallel to one another, and are then divided transversely. Some of the division stages, especially in elongate cells, resemble stages in true karyokinetic division.

The Bromes and their brown rust, by Prof. Marshall Ward, F.R.S. The author has been for some time occupied with the grasses of the genus *Bromus* and the behaviour of the *Uredo* of the brown rust (*Puccinia dispersa*) upon them. The plan of the investigation includes the nature of infection and conditions of attack, and all discoverable relations between host and parasite. The germination of the grass seeds has led to interesting points. They can be treated antiseptically in various ways and grown as pure cultures in nutritive solutions in glass tubes of various shapes, designed either to allow of the continuous aëration of the plantlet by a current of filtered air drawn through by aspirators, or not.

Such pure cultures of the grass were then infected with uredo-spores, and in ten to twelve days gave rise to *pure cultures of the Uredo*, which germinated and infected other similarly pure cultures of the grass inoculated with them.

Long series of sowings were made to test the conditions of germination of the uredo-spores. The minima and maxima temperatures of germination were found to be about 10° C. and 27°·5 C. respectively, the optimum being about 18° C. The effects of light, of other organisms (*e.g.* Algæ), of various extracts, and of the age of spores, &c., were also examined. Infection experiments on pot plants were made—several hundreds in all—on twenty-one species or varieties of *Bromus*.

The general results are, put very shortly, as follows:—Although the *Uredo* examined is in all morphological respects absolutely identical on all the species of *Bromus* on which it occurs, nevertheless if spores gathered from *B. sterilis* are sown on *B. mollis* the infection fails, whereas spores of the same batch sown on *B. sterilis* infect normally and rapidly. And similarly in other cases. Spores from *B. mollis* readily infect *B. mollis*, and (less certainly) its allies *B. secalinus* and *B. velutinus*, *B. arvensis* and others of the *Serrafalcus* group; but they fail on *B. maximus*, *B. tectorum*, *B. sterilis*, *B. madritensis*, &c.—the *Stenobromus* group—and so with other cases.

These observations lend no support to either the mycoplasm theory of Eriksson, or to any theory which attempts to explain outbreaks of rust to intra-seminal infection handed down from parent to offspring, and the author believes that the difficulties hitherto met with in understanding the sudden epidemics of these rust-diseases will disappear as we gain exact information of the conditions of germination, infection, and incubation of the disease-producing parasite; as also of its habits of lurking in the older leaves of the grass in spots where the production of a very few spores—quite invisible on a casual overhauling of the grass—prepares the way for more extensive infection as the weather changes.

Prof. Marshall Ward, F.R.S., communicated a paper by Mr. T. Barker on spore-formation in yeasts, also an account, by Mr. Howard, of a *Diplodia* parasitic on cacao and on the sugar-cane.

Pteridophyta.—Contributions to our knowledge of the gametophyte in the Ophioglossales and Lycopodiales, by William H. Lang. (1) The prothalli of *Ophioglossum pendulum* and *Helminthostachys zeylanica*. The wholly saprophytic prothallus of *O. pendulum* is at first button-shaped, but by branching the older prothalli come to consist of a number of short cylindrical branches radiating into the humus. The young prothallus and the branches are radially symmetrical. In the older parts all the cells except the superficial layers contain an endophytic fungus. The prothallus is monœcious. The antheridia are sunken, with a slightly convex outer wall one layer of cells thick; in surface view this shows a triangular opercular cell. The neck of the archegonium, which projects very slightly, consists of about sixteen cells in four rows. The central series in all archegonia yet observed consists of an ovum and a single canal cell. A basal cell is present. The prothalli of *Helminthostachys* were found a few inches below the surface of the soil in a frequently flooded jungle in Ceylon. The prothalli are radially symmetrical. The smallest were stout cylindrical structures the lower part of which was darker in tint and bore rhizoids; the upper bore the sexual organs, which arise acropetally behind the conical apical region. In prothalli which bear archegonia the vegetative region is relatively more developed, and in both these and the male prothalli it becomes more or less lobed. The antheridia are large and sunken; the slightly convex outer wall is two-layered except at the places where dehiscence may occur, which consist of single large cells. The archegonia have a neck, consisting of four rows of cells, which projects considerably.

(2) On the mode of occurrence of the prothallus of *Lycopodium selago* at Clova. The sporophyte of this plant is very common on moors, screes and crags in the Clova valley, and in these situations it seems to be reproduced almost entirely by means of bulbils. On the sometimes submerged margin of Loch Brandy, however, numerous sexually produced plants and prothalli may be found growing in the soil between the stones. The difference in the conditions under which the sporophyte can exist and those necessary for the successful germination of the spores is analogous to what has been found to be the case for *Helminthostachys*.

(3) On some large prothalli of *Lycopodium cernuum*. The prothalli of this plant, described by Treub, were of small size, one of the largest measuring 2 mm. in height by 1 mm. across. On the banks of roads close to Kuala Lumpur much larger prothalli were found. They were cake-like structures, of a deep velvety green colour, about 2 mm. in vertical thickness, but measuring sometimes 6 mm. across: they were attached to the soil by numerous rhizoids springing from the flat base.

(4) On the prothallus of *Psilotum*. The prothallus of this plant was searched for without success in Ceylon. The sporophyte occurred on tree-fern trunks on Maxwell's Hill in Perak, and a single prothallus was found there embedded among the roots of a tree-fern close to a *Psilotum* plant. No other plants grew on this tree-fern, and, although a few species of *Lycopodium* occur sparingly in the locality, there seems a strong probability in favour of this specimen being the prothallus of *Psilotum*. The specimen measured one quarter of an inch in height by $\frac{3}{16}$ inch across at the widest part. It consists of a cylindrical lower region covered with rhizoids; near the lower end of this is a well-marked conical projection (primary tubercle). The upper part widens out suddenly, and its thick overhanging margin bears numerous antheridia. In general form the prothallus resembles some small specimens of *Lycopodium cernuum*, but the upper region, from which assimilating lobes are absent, finds its closest analogue in prothalli of *L. clavatum*.

Some observations upon the vascular anatomy of the Cyatheaceæ, by D. T. Gwynne-Vaughan. In a number of Dicksonias with creeping or prostrate stems the vascular system is solenostelic, the leaf-traces departing as a single strand curved into the form of a horse-shoe, with its concavity facing towards the median line of the rhizome—*Dicksonia adiantoides*, *cicutaria*, *davallioides*, *apiifolia*, and *punctiloba*. In *Dicksonia rubiginosa* the vascular ring is interrupted by gaps other than those due to the leaf-traces, and it may therefore be termed polystelic. In

addition, there are two or three small accessory steles lying within the vascular ring. Throughout the internode the course of these internal steles is quite free from the vascular ring, but at each node one of them approaches the free margin of the leaf-gap, and completely fuses with it, separating off again after the leaf-gap has become filled up. *Pteris elata* var. *Karsteniana* has a typically solenostelic vascular ring, and also possesses internal accessory steles, which behave like those of *Dicksonia rubiginosa*, but they are relatively larger, and frequently they all fuse up together so as to form a second, inner, completely closed vascular ring. It is suggested that the several internal steles and vascular rings that occur in the Saccolomas and in *Matonia pectinata* are also of the same origin and nature as those described by the author.

Prof. Bower, F.R.S., exhibited a specimen of *Ophioglossum simplex*, n. sp., collected by Mr. Ridley in Sumatra. It appears to be entirely without the sterile leaf-lobe, though the fertile spike is characteristically that of an *Ophioglossum*. If it be actually demonstrated that the sterile lobe is really absent, this peculiar plant may give rise to considerable morphological discussion.

The anatomy of *Ceratopteris thalictroides*, by Sibille O. Ford. *Ceratopteris thalictroides* is the single member of the Parkeriaceæ. It is an annual aquatic fern which occurs in the tropics, either rooted in the mud or floating freely. The stem is much reduced; sterile as well as fertile leaves are found, both kinds bearing numerous vegetative buds. The sporangia are scattered on the under side of the fertile leaves, and have no true indusium. The roots in the mature plant arise from the bases of the petioles. An account was given of the anatomy of the leaves, roots and polystelic stem. The apex of the stem was described as having the form of a cone terminating in a three-sided cell. Miss Ford spoke of *Ceratopteris* as possessing more strongly marked affinities with the Polypodiaceæ than with any other of the leptosporangiate ferns, and as possibly intermediate in position between the Marsiliaceæ and Polypodiaceæ.

On two Malayan "myrmecophilous" ferns, by R. H. Yapp. *Polypodium* (*Lecanopteris*) *carnosum* and *Polypodium sinuosum* are two epiphytic ferns, which occur almost exclusively in the Malay Peninsula and Archipelago. Their creeping rhizomes are thick and fleshy, the ventral surface closely adhering to the substratum, the dorsal bearing the leaves, which are articulated upon large conical leaf-cushions. Branching is lateral, and is so frequent in the case of *Polypodium carnosum* that thick compact masses of interlacing stems are formed, which completely encircle the branches of the trees on which the fern grows. The fleshy stems of both ferns are traversed by an extensive system of hollow spaces, which are invariably inhabited by colonies of ants. These "ant-galleries" are arranged on a perfectly definite plan, the details of which differs to some extent in the two ferns. In both cases there is a single main ventral gallery, which runs in a longitudinal direction through the stem, giving off a lateral gallery to each branch and a dorsal one to each leaf-cushion. The galleries are formed by the breaking down of a large-celled, thin-walled tissue, which in the youngest parts of the stem appears to function as a water-reservoir. Though undoubtedly closely allied species, these ferns have been placed by many authorities in different genera.

Mr. George Brebner gave an account or the anatomy of *Danaea* and other Marattiaceæ. In *Danaea simplicifolia* the primary vascular axis is a simple concentric stele. The pericycle may be absent or only imperfectly represented. There is a definite endodermis, but it is not clear that the constituent cells are always the innermost ones of the extrastelar tissue. When the cotyledon-trace is about to be given off, the xylem of this vascular axis, or "protostele," is separated into more or less unequal portions by a layer of parenchyma. The parenchyma increases in amount, and ultimately the cotyledon-trace is separated from the central stele. The cotyledon-trace is collateral. The next few leaf-traces are given off in the same manner, and are also collateral. The stele resumes its simple "protostelic" appearance. As further leaf-traces depart from, and root-traces join, the vascular axis, the primitive structure is gradually modified, and it may become more or less crescentic, forming an incomplete, or even complete, gamostelic ring. The spaces left by the departure of the leaf-traces now constitute leaf-gaps. The vascular tissue of this stage may be described as a "siphonostele with leaf-gaps." In describing the stele of the Marattiaceæ, the author confirmed and extended Miss Shove's statement (*Annals Bot.*, 1900) as to the internal position of the protophlœm.

On the anatomy of *Todea*, with an account of the geological history of the Osmundaceæ, by A. C. Seward, F.R.S., and Miss S. O. Ford. In this paper the authors dealt with the anatomy of the stem of *Todea barbara*, which in the main agrees with that of *Osmunda regalis*, as described by Zanetti (*Bot. Zeitung*, 1895). The paper included an account of the origin of the leaf-traces, the anatomy of the "seedling" plants and a summary of the geological history of the Osmundaceæ.

Remarks upon the nature of the stele of *Equisetum*, by J. T. Gwynne-Vaughan. The vascular bundles of *Equisetum* are usually compared with those of a monostelic phanerogam, both in structural detail and with regard to their course into the leaf. Observations made upon the stems of *E. Telmateja*, &c., show that this comparison cannot be satisfactorily maintained.

The xylem of the so-called vascular bundle of *Equisetum* was described as consisting of three strands, two of which are lateral and cauline, while the median, or carinal, strand is common to both stem and leaf. The fact that only a small portion passes out as a leaf-trace, and not the bundle as a whole, constitutes an essential point of difference between it and the bundle of a phanerogam. Potonié has established a comparison between the secondary vascular tissues of the *Calamariae* and the *Sphenophyllaceae* by mentally doing away with the central mass of primary xylem that exists in the latter. By inverting this procedure, and considering it possible that the ancestors of the equisetums may have possessed a xylem that extended to the centre of the stem, one is led to derive their structure, as it exists at present, from the modification of a stele with a solid central mass of centripetal xylem, such as that of *Sphenophyllum*, or of certain Lepidodendreæ.

It is suggested that the lateral xylem strands in the vascular bundles of the existing equisetums may perhaps be taken to represent the last remnants of a primitive central mass, and that this would be entirely in agreement with their apparently centripetal development, and in particular with their cauline course.

Fossil Plants, &c.—On a primitive type of structure in Calamites, by D. H. Scott, F.R.S. Palæontological research has afforded evidence that the horsetails and lycopods had a common origin. The class sphenophyllales, restricted, so far as we know, to the Palæozoic epoch, combines in an unmistakable manner the characters of equisetales and lycopodiales, while at the same time presenting peculiar features of its own.

The synthetic nature of the sphenophyllales, indicated clearly enough in the type-genus *Sphenophyllum* itself, comes out still more obviously in the new genus *Cheirostrobus*. So far nothing has been found to bridge the gulf which separates the anatomy of the Calamarieæ (Palæozoic equisetales) from that of the sphenophyllales or the lycopods.

Dr. D. H. Scott gave an account of a calamite from the Calciferous Sandstone of Burntisland, in which each vascular bundle is characterised by the possession of a distinct arc of centripetal wood on the side towards the pith. The carinal canals are present, as in an ordinary calamite, and contain, as usual, the remains of the disorganised protoxylem. They do not, however, as in other equisetales, form the inner limit of the wood, but xylem of a considerable thickness, and consisting of typical tracheides, extends into the pith on the inner side of the canal, which is thus completely enclosed by the wood. That the organ was a stem, and not a root, is proved, not only by the presence of the carinal canals, but by the occurrence of nodes, at which the outgoing leaf-traces are clearly seen. This appears to be the first case of centripetal wood observed in a calamarian stem, and thus serves to furnish a new link between the Palæozoic equisetales and the sphenophyllales, and through them with the lycopods.

Provisionally, the new stem may bear the name of *Calamites pettycurensis*, from the locality where it occurs.

In a paper on the past history of the Yew in Great Britain and Ireland, Prof. Conwentz (Danzig) gave an account of his researches into the causes of the disappearance of this species from nearly all parts of middle and northern Europe. He expressed the view that the genus *Taxus*, which has now passed its zenith, is of no great geological antiquity; most of the Tertiary fossils described as species of yew were found to have been incorrectly determined. Prof. Conwentz dealt with a mass of evidence which he had examined, proving that the yew had been formerly widely distributed in regions where it has ceased to exist. The

evidence was derived from the microscopical examination of sub-fossil wood, the occurrence of prehistoric and historic antiquities preserved in the British Museum, in the Science and Arts Museum in Dublin and elsewhere, and from the abundance of place-names in England, Scotland and Ireland which owed their origin to the former existence of yew trees.

On the distribution of certain forest trees in Scotland, as shown by the investigation of post-glacial deposits, by W. N. Niven. The author gave a summary of facts obtained from various topographical books and other sources concerning the distribution of the following trees:—Hawthorn, elder, common ash, birch, alder, hazel, oak, willow, yew and fir, all of which, with the exception of the ash, are considered natives of Scotland. The cones of the silver fir have been dug out of the peat in Orkney, but this tree is not now indigenous to Scotland. Several shrubs, including the juniper and raspberry, as well as many flowering plants, have also been discovered. Mr. Niven pointed out that there are few parts of Scotland, however treeless at the present day, that were not in remote, and even in comparatively recent, times covered with woodlands. This is also shown by the place-names.

The evidence, which is obtained by the examination of the various post-glacial deposits, indicates in a very clear manner that the trees recorded should be considered truly indigenous to Scotland.

Prof. Potonié, of Berlin, read a paper on "Die Silur- und Culm-Flora des Harzes." On certain points in the structure of the seeds *Aethiotesta*, Brongn. and *Stephanospermum*, Brongn., by Prof. F. W. Oliver. The author gave some account of the anatomy of the fossil gymnosperm seed named by Brongniart *Stephanospermum akenioides*, and of another seed nearly allied to the foregoing which he provisionally recognised as *Aethiotesta subglobosa*, Brongn. Attention was drawn to the mantle of tracheal tissue which invests the nucellus in both cases. The possible physiological significance of this tissue was considered, and some suggestions were offered as to the conditions which led to the evolution of the seed in this group. The author expressed the opinion that there was considerable probability that the seed habit was at its origin a xerophilous adaptation.

The structure and origin of jet, by A. C. Seward, F.R.S. The author has recently examined several sections of Yorkshire jet in the British Museum, which he believes demonstrate the origin of this substance from the alteration of coniferous wood and, in part at least, of wood of the Araucarian type. Sections cut from specimens, which consist in part of petrified wood and in part of jet, enable us to trace a gradual passage from well preserved Araucarian wood to pure jet, which affords little or no evidence of its ligneous origin. The conclusion arrived at is that the Whitby jet owes its origin to the alteration of coniferous wood. The fact that jet frequently occurs in the form of flattened blocks of wood in all probability admits of the natural explanation that the jet has been derived from the wood, the form of which it has assumed, and not that the jet was formed elsewhere and permeated the tissues of the wood as a fluid bitumen.

Mr. E. A. N. Arber described a number of specimens contained in the Clarke collection of fossil plants from New South Wales. The collection, which is now in the Geological Museum, Cambridge, is noteworthy as being one of the earliest (1839–44) obtained from the continent of Australia.

A chapter of plant evolution, by A. C. Seward, F.R.S. The author described the chief features in the floras ranging from the Rhætic to the Wealden; he drew attention to the dominant types which characterised this long succession of stages in the earth's history and discussed the progress of plant-evolution from the close of the Triassic period to the appearance of angiosperms in rocks of Lower Cretaceous age.

Morphology.—Cuticular structure of *Euphorbia Abdelkuri*, by Prof. Bayley Balfour, F.R.S. *Euphorbia Abdelkuri* is an interesting succulent plant which has been brought home from a small island in the vicinity of Sokotra by the Ogilvie-Forbes Expedition. The outer surface of the plant in the fresh condition appears to be covered with a crust which readily cracks off, and on examination this is found to consist of a number of prisms. At first sight these may be taken for some form of mineral incrustation, but they are not of this nature, being formed by the cuticle of the epidermal cells. This does not form an uninterrupted layer over the epidermis, but the cuticle of each cell is separable from that of the adjacent ones, and the prisms are merely blocks of cuticle, each one belonging to a single cell. This is a construction different from that which is ordinarily met with in plants with a thick cuticular layer.

Miss A. M. Clark described abnormal secondary thickening in *Kendrickia Walkeri*, a tropical epiphytic climbing shrub. The anatomy of the young stem is typical of the family Melastomaceæ. At an early stage numerous small patches and several large wedge-shaped areas of thin-walled unlignified wood-parenchyma are cut off from the inner side of the completely circular cambium ring. Tylosis is of frequent occurrence, and the tylosed cells may develop into sclerotic cells inside the vessels and racheids. At a later stage, the unlignified wood-parenchyma cells at the central margin of the wedge area take upon themselves new growth accompanied by cell-division. The product of this new growth proceeds to split the axial woody ring into a number of portions, with subsequent destruction of the identity of the wood elements. Later, the quiescent cambium lying between the original internal phloëm and the axial woody ring takes upon itself new growth, and proceeds to lay down xylem on the one side and phloëm on the other.

The histology of the sieve tubes of *Pinus*, by A. W. Hill.—The author's researches have proved that the results obtained by Russow are, in the main, correct; the mature sieve-plate is traversed by groups of callus rods, which are interrupted at the middle lamella by median nodules, and each callus rod contains from three to seven striæ—or spots if examined in surface-view—which are strings of slime. The youngest sieve-plates or pit-closing membranes, which could be examined, showed "connecting threads" like those in ordinary tissue; but in the so-called "boundary cells"—*i.e.* the youngest thick-walled sieve-tubes—a change takes place, namely, the appearance of the callus. Callus first appears on one surface of the sieve-plate, at the places where the groups of "connecting threads" occur, and it gradually spreads as a rod along a group of the threads to the middle lamella; a similar change then takes place on the other side of the lamella. The lamella itself, however, is not converted into callus, but a refractive median nodule appears separating the two portions of the callus rod. Accompanying this change the protoplasmic threads become converted into slime strings. The changes described were considered by the author to be due to the action of ferments.

Dr. Lotsy dealt with examples of heterogenesis in conifers. The expressions heterogenesis (Korschinsky, "Flora," 1901), mutation and spontaneous variation have practically the same meaning, and are applied to phenomena which illustrate one method by which new species may be formed. The author exhibited a specimen of *Capsella Heegeri*, given to him by Count Solms-Laubach, who recently described this species as a new form which appeared to have arisen suddenly from *Capsella bursa pastoris* (*Bot. Zeitung*, 1900). Reference was made to Hugo de Vries' important publication ("Mutationstheorie") in which several new species are described as having been formed as the result of sudden variations, which were manifested during certain periods of spontaneous variation. Dr. Lotsy drew attention to two genera of conifers—*Cupressus* and *Thuya*—which he described as passing through a period of spontaneous variation. Among a large number of seedlings of *Cupressus Lawsoniana* two plants were raised which exhibited marked differences—*C. Lawsoniana Wisseti* and *C. Lawsoniana lycopodioides*, forms which would undoubtedly be described as new species if their common origin were not known. *Thuya occidentalis Spaethi* was also described as a new form which had been produced as the result of sudden variation.

Mr. John Paterson read a paper in which he dealt with the biology and anatomy of *Stellaria holostea* and allied species. He gave a brief comparative account of the anatomical structure in *Stellaria graminea*, *S. media*, *S. glauca* and other Caryophyllaceæ.

Mr. W. C. Worsdell submitted a paper on the morphology of the ovule; an historical sketch. The same author communicated a note on the morphology of the "flowers" of *Cephalotaxus*, containing an account of original observations on proliferated inflorescences and flowers, which afforded evidence in support of the foliolar theory of the ovule as put forward by Celakovsky.

Physiology, &c.—Prof. Kny (Berlin) read a paper on Correlation in the growth of roots and shoots, in which he dealt with certain criticisms directed by Heering (*Pringsheim's Jahrb.*, 1896) against a communication on the same subject published by the author in 1894 (*Annals Bot.*). In the first paper the final results, and not a detailed account of the experiments, were published. Prof. Kny stated that his recent experiments had shown

that in cuttings of *Ampelopsis quinquefolia*, as in those of certain species of *Salix*, the continual removal of the young shoots was soon followed by a less vigorous development of roots, and *vice versâ*. In *Salix* the retarding influence is first apparent in the roots, while in *Ampelopsis* the shoots were found to be the more sensitive.

Dr. F. F. Blackman and Miss Matthaei contributed a paper on natural surgery in leaves (*Annals Bot.*, 1901). If patches of leaf-tissue be killed in any way, the leaf reacts by forming an "absciss"-line round the injured spots at a little distance off in the healthy tissue. Separation soon takes place at this "absciss" line, so that the dead tissue which might be a source of danger is cut right round and drops out of the leaf. The same authors gave a paper on the relation between CO_2 production and vitality. This communication chiefly dealt with the effect of loss of water upon the CO_2 production in leaves. Even a small loss of water causes a very marked increase of the CO_2, and this effect continues until the water is restored

On the absorption of ammonia from polluted sea-water by *Ulva latissima*, by Prof. Letts and John Hawthorne. In a previous research (*Proc.* Roy. Soc. Edin. 1901) it was shown that the occurrence of this sea-weed in quantity in a given locality is associated with the pollution of the sea-water by sewage, the evidence being of three kinds: (1) The high proportion of nitrogen contained in the tissues of the *Ulva*; (2) an examination of certain localities in which the sea-weed occurs in abundance, and of others from which it is virtually absent; and (3) experiments on the assimilation of nitrogenous compounds by the growing *Ulva* from sea-water artificially polluted.

The following conclusions were drawn from recent experiments:—(1) The absorption of ammonia by the sea-weed is very rapid, and with the mixtures used practically all the ammonia was absorbed in five hours (with one exception, when 75 per cent. was lost). (2) The amount absorbed is greatest during the first hour of contact, and then rapidly falls off. (3) Although the concentration of the ammonia exercises some effect on the proportion absorbed, it is by no means so considerable as might have been expected. (4) The sea-weed absorbs ammonia both in daylight and in darkness, but the proportion in the latter case is rather less than in the former. (5) The effects of an increased area of the sea-weed on the proportion of ammonia absorbed are not so great as might have been expected. These results may be of practical importance in those districts where a serious nuisance results from the decay of large quantities of the *Ulva*, which have been washed ashore, or have accumulated in shallow water.

The diameter increment of trees, by A. W. Borthwick. There are two methods by which the rate of growth in thickness or diameter increment of trees can be ascertained. One of these methods is to measure annually or at certain intervals the diameter or circumference by means of tree callipers or a tape. The only other method of investigating the diameter increment on standing trees is by means of a very useful instrument known as Pressler's increment-borer. Mr. Borthwick stated that through the kindness of Prof. Bayley Balfour he had recently had the opportunity of testing whether the increment-borer would yield the same results as those furnished by the tape. A comparison of results showed a close agreement between the two methods.

Dr. R. J. Anderson described an apparatus for studying the rate of flow of solutions in plant stems, and gave a preliminary account of experiments on which he is at present engaged.

On the strength and resistance to pressure of certain seeds and fruits, by Prof. G. F. Scott Elliot. The author described experiments which he had made in order to determine the amount of weight which seeds can endure without breaking. The experiments were generally conducted by means of a spring balance weighing up to 50 lbs.; seeds and fruits which withstood a pressure of 50 lbs. were tested with a Wicksteed's single-lever vertical testing machine. The paper dealt also with the relation between the resisting power and the shape and structure of seeds. Attention was called to various peculiarities of fruits and seeds which serve as important aids to their resisting power.

Forestry.—Mr. Samuel Margerison communicated a paper on the transport of British timber. He drew attention to the fact that imported fir sold at a less price than that at which British fir can be delivered, and urged the desirability of bearing in mind the question of transport in the scientific development of our forests.

Mr. G. P. Hughes gave an account of Government plantings in the Isle of Man.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—Mr. David B. Monro, Provost of Oriel, succeeds the Rev. Dr. Fowler, President of Corpus Christi College, as Vice-Chancellor.

CAMBRIDGE.—The moderators for the mathematical tripos, 1902, are Mr. W. Burnside, F.R.S., Pembroke, and Mr. J. Greaves, Christ's. The examiners are Mr. J. G. Leathem, St. John's, and Mr. J. H. Grace, Peterhouse.

The outgoing Vice-Chancellor, Mr. Chawner, Master of Emmanuel College, in his valedictory address, stated that the amount received for the Benefaction Fund was more than 66,000*l*. This, though it falls short of what is required even for the pressing needs of the University, has made it possible to enter into contracts for the Botany School, and a substantial portion of the Medical School buildings. Dr. Lawrence Humphry has been appointed assessor to the regius professor of physic, and Sir R. S. Ball an elector to the Isaac Newton scholarships. Prof. W. R. Sorley has been elected to a professorial fellowship at King's College Prof. Somerville has informed the Vice-Chancellor that, having accepted a post in His Majesty's Board of Agriculture, he will resign the chair of agriculture at the end of the present term. Mr. K. Lucas, of Trinity College, has been nominated to occupy the University table in the Marine Biological Laboratory at Plymouth, Mr. J. H. Jeans, second wrangler 1898, Smith's prizeman 1901, and Mr. H. A. Wilson, research student in physics 1899, have been elected to fellowships at Trinity College.

IN delivering the opening address of the winter session of St. Andrews University last week, Principal Donaldson spoke on the subject of Mr. Carnegie's recent gift and the relation of the universities to the trade and commerce of the country. With reference to the first part of his subject Principal Donaldson said that the gift of Mr. Carnegie rendered it possible for every Scotsman to obtain a university education if he was capable of it; its second purpose was to increase the usefulness and influence of the Scottish universities by furnishing them with lectureships, laboratories, scholarships of research, and every form of equipment that could enable them to do their work most effectively. It was impossible to estimate the value of this part of the gift, of the possibilities which it created, and of the good that it would do to the whole community. It would bring all the various departments of study up to a high level, and especially it would promote in the highest degree original inquiry and investigation. For want of means they had fallen behind in this department, but the difficulties were now removed. Every student who had the ability to conduct original research would have his opportunity, and they might expect Scotland to take a foremost place in those scientific discoveries and inventions which were the prominent feature of our age.

SPEAKING on Saturday last to the Medical Faculty of University College, Liverpool, Prof. Oliver Lodge, F.R.S., Principal of Birmingham University, said a year ago he did not expect to find the full University ideal so prominently to the front; but any hesitation that might have been felt at urging it too hastily or inopportunely had been removed by the resolution of their council—their college council and likewise their city council—that a University for Liverpool was a necessity, and that any step towards furthering of that object would be welcome. The multiplication of municipalities, said Dr. Lodge, was wholly good. Why should the multiplication of Universities be considered bad? Let every city become a University when it was worthy, but it must make itself worthy first. Proceeding, he said that one of the functions of a University was the increase or improvement of knowledge, what was called "research." The ancient formula of the Royal Society stated that it existed "for the improvement of natural knowledge." He commended to their notice this word "improvement." Their primary aim should be improvement. The guardians of knowledge must be improvers of it, else it began to decay and to be lost. A University was the corporate repository of learning, not of ancient learning only, but of modern learning too; the most recently discovered fact of science there found its natural guardians, and there it was that new facts should be born. He commended this notion of "improvement of knowledge" to students, to every class of student. An atmosphere of constant effort towards the

improvement of knowledge, with the accompanying stimulus of potential discovery; this was the atmosphere that should enfold every earnest student who entered the portal of a modern University.

THE new department of pathology of the University of Oxford was formally inaugurated on Saturday last. The building, which has been erected at the cost of about 10,000*l.* (5000*l.* of which was the gift of Dr. Ewan Fraser, of Balliol College), occupies a site at the back of the University Museum. It is rectangular in shape, measuring 75 feet by 65 feet, and consists of a basement and two storeys, the rooms being grouped round central vestibule. Amongst the latter are a lecture room, a museum, laboratories for the teaching of morbid histology and of bacteriology, research rooms for work in experimental pathology and in chemical pathology, and various store rooms, attendant's work room, workshop, and cold-room are also provided. Sir William Church, president of the Royal College of Physicians, in delivering the opening address, said that the eightieth anniversary of the birthday of the Nestor of pathological research, Prof. Virchow, being that day celebrated, Oxford could not in a more worthy way pay its homage to the veteran man of science. Just at the time that their museum was being erected, Prof. Virchow gave to the world his memorable work, "Die Cellular Pathologie," which placed pathology on a new foundation and taught them to regard pathological processes as the perversion of physiological ones, influenced by various disturbing agencies. Pathology could not be studied without physiology, neither could physiology in its completeness be carried on without pathology, and more especially had this become manifest since they had been acquainted with the part played by micro-organisms in the universe, and the influence they had on living structures. A knowledge of both physiology and pathology was indispensable for those who would practise medicine; but to regard pathology as a mere adjunct to medicine was to take a narrow and erroneous view of the processes of nature. As a physician he could not but regard with extreme satisfaction the addition which had been made to the opportunities afforded to their medical graduates for the acquisition of scientific knowledge, but he was far from looking upon the technical work which would be done in direct connection with medicine as the only, or, indeed, the main, advantage which would accrue from it. Pathology at the present time was, above all others, that section of medical science which offered the widest promise of progress, and by the original research which under the guidance of the able head of their pathological department would there be carried on, he trusted that real advances in knowledge might be made which both directly and indirectly might benefit mankind, and that in pathology, as in the other departments of science, Oxford might hold an honourable record.

SOCIETIES AND ACADEMIES.

PARIS.

Academy of Sciences, October 7.—M. Bouquet de la Grye in the chair.—On the extension of a formula of Euler and on the calculation of the principal moments of inertia of a system of material points, by M. K. Bohlin.—General properties of couples of kinematic elements, by M. G. Kœnigs.—The action of urethane on pyruvic acid, by M. L. J. Simon. Pyruvic acid combines directly with urethane without the use of any condensing agent, the compound $CH_3.C(NH.CO_2C_2H_5)_2CO.OH$ being formed. The ethyl ester of this substance can also be obtained by condensation of ethyl pyruvate with urethane, but in this case a little hydrochloric acid is necessary to assist the reaction Boiling with dilute acid readily regenerates the pyruvic acid.—On monobromomalonic dialdehyde, by M. R. Lespieau. This substance is formed by the action of bromine in bright sunlight upon the substance $CHBr:CBr.CH_2OCH_3$. Owing to its forming a potassium salt it was at first taken for an acid, but its aldehydic nature is clearly established by its reactions with Schiff's reagent, and the formation of phenylbromopyrazol with phenylhydrazine.—On the reducing properties of certain nitric esters, by MM. Leo Vignon and F. Gerin. The nitric esters derived from methyl and ethyl alcohols, glycol and glycerol do not reduce an alkaline copper solution. Tetranitroerythritol possesses faintly reducing properties whilst a strong reduction is produced by the nitrates of dulcitol and mannitol.—Experimental researches on the excitability of the spinal marrow, by M. Alex. N. Vitznou. It is shown that, contrary to the results of previous experimenters, the grey matter of the spinal column can be excited by electric currents, and that there is a clear difference between the reactions which are produced as a consequence of the stimulation of the antero-lateral cords and those resulting from the stimulation of the grey matter, the latter producing generally tetanic movements. The grey substance can also be excited by simply mechanical means, if care be taken that there is as little loss of blood as possible during the preliminary operation.—The influence of spermotoxin upon reproduction, by Mlle. C. de Leslie. If some spermotoxic serum furnished by a guinea-pig is injected into a white mouse, the latter loses its power of reproduction, the sterility being maintained for from sixteen to twenty days.—On the liberoligneous elements of ferns, by MM. C. Eg. Bertrand and E. Cornaille.—Double flowers and parasitism, by M. Marin Molliard. In two cases (*Primula officinalis* and *Scabiosa Columbaria*) in which a tendency to form double flowers was observed, it was found that the roots were attacked by parasitic fungi, and it appears very probable that it is to these parasites that the changes in the flowers must be attributed. The author points out that these facts may have important applications in practical horticulture.—An experimental contribution to the study of the physical signs of intelligence, by M. N. Vaschide and Mlle. M. Pelletier. As the result of measurements made on more than 300 children it was found that the cephalic development of the intelligent subjects was different from an anthropological point of view from the unintelligent subjects. The most marked difference is in the magnitude of the auriculo-bregmatic measurement.

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