THURSDAY, OCTOBER 10, 1912.

FIVE NEW SCHOOL GEOGRAPHIES.

(1) *Cambridge Geographical Text-books—Intermediate.* By A. J. Dicks. Pp. xi+362. (Cambridge: University Press, 1912.) Price 3*s*.

(2) *Physical Geography for South African Schools.* By Alex. L. Du Toit. Pp. xii+250. (Cambridge: University Press, 1912.) Price 4*s*. 6*d*. net.

(3) *A Geography of Europe.* By T. Alford Smith. (Macmillan's Practical Modern Geographies.) Pp. xi+272. (London: Macmillan and Co., Ltd., 1912.) Price 2*s*. 6*d*.

(4) *A Class Book of Physical Geography.* By A. T. Simmons and E. Stenhouse. Pp. viii+436. (London: Macmillan and Co., Ltd., 1912.) Price 4*s*. 6*d*.

(5) *The Marlborough Country.* Notes, Geographical, Historical and Descriptive, on Sheet 266 of the One-inch Ordnance Survey Map. By H. C. Brentnall and C. C. Carter. Pp. 171. (Oxford: University Press; London: Henry Frowde, 1912.) Price 2*s*. 6*d*. net.

THESE are five up-to-date geographies, each emphasising, more or less, the chief features of what has now for the last seven or eight years come to be known as the "New Geography."

(1) The Cambridge "Intermediate" is a general geography. It is worked on the lines of cause and consequence, the why and the wherefore. Each section dovetails into its immediate predecessor in logical order, thus:—

(*a*) Mathematical geography and relation of land and water *lead to* climate;

(*b*) Climate *leads to* flora and fauna;

(*c*) Flora and fauna *lead to* distribution of population, development of industry, &c.

These three divisions occupy one-eighth of the book proper. The remaining seven-eighths applies the principles enumerated to the great continental regions of the world in the old-time order—Europe, Asia, Africa, Australasia, America. This is exclusive of a large supplementary list of examination questions, and of a fairly copious index of place names. The questions are not all that could be desired. Too many are merely essay subjects, as "Of what value is the study of geography?" and "Write an essay on the German people, and their position in Europe at the present time." Some of the statements in the text, too, require qualification, *e.g.*, that the trans-Andine railway runs *through* the Uspallata Pass, and that the Egyptians belong to the Hamite race.

(2) Offers the usual contents of a physical geography—earth, air, water, fire, land-forms and life—but draws its examples, as well as its pictures, from South Africa, and adds a concluding chapter on the physical geography of South Africa itself. Its strong point is its geology, which becomes the weak point of its geography—for there is far too much of it. The human interest suffers. This appears to be a defect throughout. There is a maximum of man's environment and a minimum of its effects on man himself. The value of the book to *English* teachers will lie in the novelty of the South African examples, which at once takes it out of the ordinary run of our school books. Its style strikes one as very stiff for class work, and there are no exercises. A full, if somewhat pretentious, bibliography is given at the end.

(3) Attacks the regional geography of Europe on modern lines. The various "lessons" consist of (*a*) practical exercises, (*b*) descriptive matter, (*c*) questions. Teachers who know Macmillan's "Practical Modern Geographies," of which series this is one of the latest volumes, have nothing but praise both for the matter and for the method of the books. In dealing with Europe regionally, it is, of course, impossible to ignore the political divisions, but Mr. Alford Smith rightly lays great stress on their physical bases.

A special instance will show the method of treatment. Chapters xiv.–xviii. are allotted to Germany, and are headed: Climate and Vegetation, Races of People, Coalfields, The Rhine, North Sea Ports—five headings which pick out the salient features of the country. To ensure the inclusion, or at all events the non-exclusion, of the other features, practical exercises are added on allied subjects, *e.g.*, distribution along with races of people, manufactures with coal, commerce and trade with ports.

(4) An excellent book—treats physical geography as an intensely practical subject. Here, too, exercises, descriptions, and questions follow each other. The value of an exercise lies in its stimulus for investigation; the boy must use his school atlas, his book of reference, his instruments. He must become, therefore, to a certain extent an independent observer—which is excellent, and very satisfactory to all concerned, and is the very *raison d'être* of all books of this type. But to work out his exercises he must be assisted here and there with *clear* accounts of geographical phenomena. The authors of this physical geography are to be congratulated on the clarity of their descriptions. The section on winds, even though "wind roses" may not give a wholly correct idea of the winds of a given district, may be turned to as an example. He would be a dull boy, or girl, who could not grasp the principles of

the monsoons and the influence of the heat equator from these pages.

(5) "The Marlborough Country" should be as interesting to a tourist with a bent for geology, or archæology, or nature study, as it is useful to a teacher who wants to deduce from an ordnance map the immense amount of information which lies hidden beneath its signs and symbols. The Marlborough district map (sheet 266 of the one-inch ordnance survey map) is in this little book made to yield up as subject-matter for observation the reading of relief maps in general, the physical divisions of the "Marlborough Country," its geology, climate, farm life, communications, distribution of population, history and archæology, let alone such specialities as the Downs, the Vale of Pewsey, Savernake Forest, and a host of miscellanous local topics. The book is a novelty, and has more than a local interest. It is a pioneer, an exemplar, in the science of home geography.

Summarising generally, all five books are suitable for the middle and higher forms of a secondary school. No. 1 is well got up, of taking appearance, but rather sketchy, and inferior, in our opinion, to its "Oxford" rivals. No 2 must fill a great void in South Africa, but is naturally not so well adapted for British schools. Nos. 3 and 4 are on similar lines, and belong to the excellent type of book of which Simmons and Richardson's "Introduction to Practical Geography" was the first exponent. No. 5 has for its staple just the kind of information that a guide-book relegates to its introductory pages, and as for its interjectory questions—well, the ordinary man may ignore them, while the teacher will find them extremely useful.

LABORATORY CHEMISTRY.

(1) *Outlines of Inorganic Chemistry.* By Dr. E. B. Ludlan. Pp. xv+365. (London: Edward Arnold, 1911.) Price 4*s.* 6*d.*

(2) *A Handbook of Organic Analysis, Qualitative and Quantitative.* By Hans Thacher Clarke, with an introduction by Prof. Norman Collie, F.R.S. Pp. viii+264. (London: Edward Arnold, 1911.) Price 5*s.* net.

THE methods of teaching chemistry, particularly inorganic chemistry, are so diverse and depend so much upon the individuality of the teacher that it is no wonder there are a large number of books on elementary chemistry, and that their number is still increasing.

(1) Mr. Ludlan's book is very readable, and is illustrated with portraits of Lavoisier, Priestley, Scheele, Faraday, Dalton, and Humphry Davy. We like the introduction of such portraits in a book on science because it helps the student to remember historical facts, and impresses upon his memory the importance of the work of the persons whose portraits appear.

The author commences with a brief discussion on early notions which for many reasons, mainly for the want of the balance, were incorrect. The moral impressed is: "Be sure of your facts before trying to explain them." Some of the questions at the end of the chapters are unusual; for example, "How would you attempt to establish the truth or inaccuracy of the following statements: 'Sunshine puts the fire out'; 'Sunshine makes colours fade'; 'A watched kettle never boils'?" These questions may be suitable in a class, but are somewhat puerile in a book, more particularly as the chapter in question does not deal with them—it happens to be "On the Rusting of Iron." But anyone who works carefully through the book will obtain a good foundation of elementary chemistry.

(2) The second book is of a very different character, being on organic analysis. It is only fairly recently that books on organic analysis have been published in which any attempt has been made at classification. Of course, the difficulties of classifying substances of such diverse nature and properties as occur in organic chemistry are very great, and when all is said and done organic analysis is not in general so exact as inorganic analysis.

Prof. Collie, who writes an introduction to the book, remarks that "The examination of inorganic ions too often tends to degenerate into a series of arbitrary tests, memorised and applied without much consideration of their theoretical bearing." Some years ago, when everything was worked by the "chart," this was to some extent true, but the more modern books almost always insist most strongly on a mastery of the theoretical as well as the practical aspect. It is a strange fact that an organic chemist is apt to think lightly of inorganic chemistry and *vice versa*, and yet each branch has its own difficulties and importance.

The first chapter of the book before us deals with the preliminary investigation of the substance or substances to be analysed. Tests for purity, such as melting point, boiling point, and fractionation, are enumerated—we say enumerated instead of given, because the description is rather inadequate; for example, Distillation under reduced pressure: this is followed by tests for carbon and hydrogen and further preliminary tests with the object of sorting into groups such as phenolic, acidic, neutral, &c. The next chapter deals with the examination for radicles; it is well

written, and the facts are grouped together in a very useful manner. The third chapter practically completes the qualitative portion of the book, and is followed by tables of organic compounds in which the properties and physical constants of a large number of the most generally met with organic compounds are compiled—it is, in fact, a short dictionary. This section will most certainly be found very useful in the laboratory, and has been very painstakingly compiled.

The rest of the book deals with quantitative analysis, combustions, nitrogen determinations, vapour densities, optical rotation, and other methods which are employed in the laboratory.

LOCAL AND GENERAL GEOLOGY.

(1) *Transactions of the Paisley Naturalists' Society.* Vol. i. Notes on the Mineralogy of Renfrewshire. By Robt. S. Houston. Pp. 88. (Paisley: Alexander Gardner, 1912.) Price 2*s.* 6*d.* net.

(2) *Physiography for High Schools.* By Albert L. Carey, Frank L. Bryant, William W. Clendenin, and William T. Morrey. Pp. vi+450. (Boston, New York, Chicago: D. C. Heath and Co.; London: George G. Harrap and Co., 1912.) Price 4*s.* 6*d.*

(3) *Structural and Field Geology. For Students of Pure and Applied Science.* By Prof. James Geikie, F.R.S. Third edition, revised. Pp. xxiv+452. (Edinburgh: Oliver and Boyd; London: Gurney and Jackson, 1912.) Price 12*s.* 6*d.* net.

(1) MR. HOUSTON'S volume, attractively produced and excellently printed, cannot fail to arouse interest in local mineralogy. A preface is given on the geology of Renfrewshire, and we are reminded of the famous specimens of prehnite and analcite from the Boylestone Quarry, near Barrhead. New analyses are given of several minerals, including phosphatic nodules (p. 72) from three localities, and a greenish kaolin (p. 71). The name "lithomarge" is misprinted in three places, and we do not like the term "carbonated" on p. 78 in place of "carbonised." But considerable care has evidently been given to the book, which serves as a model for the work of local naturalists.

(2) We now possess several good English books on physiography, and have received much stimulating aid from the United States. Hence it is questionable if another American work is likely to find a free place in our schools. Four high-school masters, however, have collaborated in New York City in producing a clearly written account of natural phenomena, illustrated with views and maps from the wide field available in the United States. Unlike Huxley, they set aside the biological aspects of physiography, and they omit in consequence a good deal that would interest a schoolboy in the surface-features of his country. The work is terse and lucid, but seems somewhat cold and uninspiring; its method of construction has prevented any one of the authors from impressing on it the mark of personality. A few good books of scientific travel would probably set young pupils thinking to far more purpose about the earth. Physical geography in the high-school stage already runs the risk of becoming stereotyped. Certain set names for phenomena require certain definitions. Meanwhile, the rock is removed out of its place and the waters wear the stones, while the eye of the pupil, made for wonder, remains fixed upon the printed page.

(3) Prof. James Geikie's "Structural and Field Geology" now reaches a third edition. In its fine use of full-page photographic plates it aims at accurate illustration of what will be encountered in the field. No one can convert these pictures into diagrams for the note-book; they are, as the author intends, direct encouragements to observe. Rocks are photographed from actual specimens, and the landscapes and field examples are largely derived from the series of views brought together by the Geological Survey. The book is a broad treatise on physical geology, written with a remarkable absence of technicalities. It goes, perhaps, too far in avoiding chemical considerations, such as those involved in the formation of laterite (p. 58) and cornstones (p. 70), and in omitting even chemical formulæ, which would be helpful in the description of the silicates. Methods of testing minerals and rocks are introduced as they happen to be required, and it is clear that the work should be read continuously. Among its best features are the drawings of block-models of faulted strata (pp. 162 and 166), which explain many of the puzzles of geological maps. The trough-faults in Fig. 53 might gain by a cross-reference to their explanation in Fig. 54.

The principles of geological surveying receive unusually full treatment, and attention is given to economic questions and to the broad characters of soils. Chapter xxv., on geological structure and surface features, might, of course, be greatly elaborated. The twenty-three lines devoted to coast-lines seem inadequate in comparison with forty-five pages given to ore-formations in chapter xvi., a subject not closely related to structural geology. Prof. James Geikie's book, so handsomely set before us, will long remain our best introduction to geological phenomena as they actually present themselves to the observer.

GRENVILLE A. J. COLE

WHAT IS INSTINCT?

The Evolution of Animal Intelligence. By Prof. S. J. Holmes. Pp. v+296. (New York: Henry Holt and Co., 1911.)

THE study of animal behaviour has two problems, description and interpretation. Both give opportunities for error. Thus on the one hand Binet's discussion of the mental life of Protozoa is largely based on a mistaken view of the facts. Didinium does not "hunt" its prey or "cast darts" at it. On the other hand Thorndike, on the basis of his well-known experiments, argued that his animals showed no high degree of intelligence because there was no sudden drop in their learning curves; Hobhouse opposed this conclusion on the ground that the curves did show a sharp drop. But in a recent article comparing human adults, children, and rats in learning a maze, Prof. Hicks finds that "the relation between the abruptness of slope and the degree of rational ability is just the inverse of that assumed by Thorndike and Hobhouse."

As this example suggests, problems of interpretation lead inevitably to questions of human psychology. Now we know considerably less about human methods than the old naïve anthropomorphism assumed. Nevertheless, the work already done by general psychology upon many of the problems of interpretation occurring in animal psychology cannot profitably be ignored. The failure to recognise this fully somewhat detracts from the value of Mr. Holmes's discussion of that central problem, the nature of instinct. His treatment seems to imply that the distinction between reflex action and instinct is merely one of degree or complexity.

Spencer's view is, of course, one for which many arguments may be found, but, in any attempt to discuss the matter at all fully, it should surely be made clear that a very different opinion has been taken by most of those approaching the question from the psychological, rather than the biological, viewpoint—the opinion, namely, that instinct is essentially conscious, involving elements of striving, feeling and cognition. Curiously, Mr. Holmes quotes with approval a well-known passage from James which insists on the essential kinship of animal instincts with human impulses, without apparently seeing how incompatible this conception is with any attempt to define instinct in terms of mere movement. Certainly, unless all interpretation is delusive, it seems clear that in many cases consciousness is necessarily involved. A bird building a nest or feeding its young is not merely executing a series of movements which happen to produce a given result. On different occasions this result remains the same while the exact movements and their order are continually varying; that is, the result is not merely an effect but also a cause: we have not merely movement but action.

In discussing puzzle-box tests of intelligence Mr. Holmes rightly agrees with Prof. Hobhouse that the frequent variation of method in lifting the latch, &c. (*e.g.*, using either paw), is conclusive against attributing everything to sensori-motor association. But the same argument seems decisive against regarding instinct as a complex of reflexes. Its framework is fixed; the gaps, however small, have to be varyingly filled in by conative and intellectual processes of at least the perceptual level.

Into the relation of instinct to intelligence it is impossible to enter. The use of intelligence as equivalent to the power to form associations may be justified if one means merely that which is opposed to instinct, but it fails to find any place for that perception of relations which is to be found selecting means to ends whether given by congenital or experiential orientation.

If Mr. Holmes's discussion of central theoretical questions is not altogether satisfying, his book is extremely interesting if only because of the amount of concrete illustration. It is unfortunate that a number of slipshod phrases has been allowed to pass.

OUR BOOKSHELF.

Their Winged Destiny, being a Tale of Two Planets. By Donald W. Horner. Pp. 240. (London: Simpkin, Marshall and Co., Ltd.) Price 2*s.* net.

THERE are about one hundred million suns in space; and it is reasonable to suppose that many of them have planets revolving round them similar to those which form our own solar system. Whether life exists upon any of these bodies is a matter of legitimate speculation. It is, perhaps, possible that among so many bodies there is one which has gone through precisely the same stages of development as the earth, and upon which the same forms of life are in being. This hypothesis provides Mr. Horner with the basis of his fantastic romance.

As in Mr. Wells's impressive story of "The Star," a new star appears and threatens to destroy the earth. To avoid the calamity, a party leaves the earth in an "Electronship," which can travel with the velocity of light, and after four years arrives at the system of α Centauri, where black and white giants were at war on one planet, while another was found to be exactly like the earth, not only as regards the distribution of land and water, but also in its inhabitants, who spoke the same languages as the peoples of our globe. Slight differences of mechanical and social development

led to difficulties when the travellers settled down upon the Centaurian planet; and eventually the party returned to the earth again to find that it had not been annihilated, the new star having passed outside our system.

There is, of course, a love story to give human interest to the adventures; and some amusing and exciting episodes lighten the monotony of a tiresome journey. As an attempt to combine fact with fiction, the story is not without merit; but the style is commonplace, and such a split infinitive as "to quietly and unostentatiously do" is enough to make any lover of good literature shudder. R. A. G.

Catalogue of the Periodical Publications in the Library of the Royal Society of London. Pp. viii+455. (London: Printed for the Royal Society at the Oxford University Press and sold by Henry Frowde, 1912.)

Catalogue of the Periodical Publications, including the Serial Publications of Societies and Governments, in the Library of University College, London. By L. Newcombe. Pp. vii+269. (Oxford: Printed for University College, London, by Horace Hart, 1912.)

THE general plan of both these catalogues is similar, and this is natural, since the Royal Society catalogue has been compiled by Mr. Newcombe, sub-librarian of University College, London, and Mr. L. Ellston.

A catalogue of periodical publications in the library of the Royal Society was last printed in 1881, and the large number of accessions to this section of the library in the succeeding thirty years rendered a new catalogue imperative. Instead of adopting the plan of the old catalogue, with its classification under eight separate alphabets, the present has been arranged under one alphabet and restricted as closely as possible to periodical works.

The catalogues will prove invaluable to scientific workers who make use of either library, for the task of discovering a volume has certainly been made as light as possible.

Bacon's New Globe with Contour Colouring. Natural Scale 1/37,000,000. Price 25*s*.

THE globe is nearly fifteen inches in diameter, weighs about four and a half pounds, and is consequently easily portable. It is provided with a brass graduated semi-meridian and a conveniently-arranged compass. The colour scheme is based on that of the International Map Committee, and the relative land levels and sea depths are both indicated.

The large number of names included has made the size of type very small, and few places can be read even at a short distance. This will interfere with the use of the globe for class purposes. For individual study the globe will prove useful, and its use may be recommended to correct the wrong impressions formed by an exclusive examination of flat maps.

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.*]

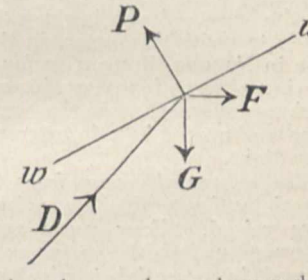
Sailing Flight of Birds.

COMING out from Queenstown on September 10 on her way toward Boston, the ss. *Arabic* was accompanied for some hours by a large flock of gulls. For the most part these birds were visibly working, flapping their wings, but occasionally a few would cease flapping and merely sail along for considerable distances, keeping up with the ship or even gaining upon it, sometimes descending, sometimes ascending, apparently at will, with no perceptible action of their wings except, now and then, a slight effort which seemed to be needed for preserving equilibrium, not for support or for propulsion. The wind was of such direction and velocity that the smoke from the ship's funnel went astern in a trail making an angle of, perhaps, 30° with the keel.

Having at first no reasonable theory of the sailing which the gulls practised, I watched them intently for some time, and made the following observations:—

(1) The sailing occurred almost wholly, if not quite so, over or near the windward side (the starboard) of the ship, at moderate heights, 20 to 40 ft. perhaps, above the level of the uppermost deck, and not very near the bow.

(2) When a bird was sailing parallel to the course of the ship, the line from beak to tail was very nearly, if not quite, parallel to the trail of smoke from the funnel. If the gull turned so as to make his own axis more nearly parallel to the keel of the ship, he drifted to leeward; if his axis was turned somewhat farther from the direction of the keel than at first, he went to windward. Apparently the head and neck served as a bow rudder for small changes of direction, the whole body soon following the course indicated and initiated by this part.



(3) When a bird was sailing along with the ship his head was held rather low. If he raised his head and lowered his tail, he was carried to leeward or astern with great velocity; this frequently happened, for it was evident that most of the food was discovered by the gulls behind the sailing ones, and the greater part of the flock was usually there.

(4) When, through a shift in the wind or in the course of the ship, the smoke began to trail out nearly astern, a change which occupied a few minutes only, the sailing of the birds ceased, each one being then obliged to make visible effort to keep up with the ship.

An explanation of the ability of the birds to sail, under the conditions described above, is, I believe, found in the upward course of the wind which has struck the weather side of the ship and must rise in order to pass over it. Given a brisk, steady, upward current of air, a gull, with its highly practical knowledge of mechanics, can, of course, sail in any direction. Thus, in the figure here given, if *ww* represents a wing-plane, D the direction of the current of

air, P the net wind-pressure on the wing-plane, G the pull of gravity, the bird's weight, and F the frictional resistance[1] encountered by the bird in moving through the air, we have indicated a solution of the problem of support and of propulsion, propulsion in a direction opposite to that of the horizontal component of the wind's velocity.

As the trail of smoke marks the direction of the wind with respect to the moving ship, the bird must, in order to sail with the same velocity and direction as the ship, have a motion relative to the air equal and opposite to the motion of the smoke relative to the ship. Accordingly, the bird's axis is kept parallel to, and opposite to, the course of the smoke as indicated by its trail from the funnel.

With a head-wind, though there must be an up-current near the bow, this current must be much more narrowly local, and therefore less advantageous for the bird's use in sailing, than the up-current produced by a wind abeam.

It would appear that the gulls when sailing are not directly seeking food, but are merely resting, loafing for the time being, with ears intent, however, for any indication of a find by their more industrious brothers astern.

Having shown this discussion to a number of well-known physicists aboard the *Arabic*, I find no opposition to the theory proposed for the facts as noted, but a very general doubt as to whether gulls do not sometimes sail on the leeward side of a ship or too far astern to get the benefit of the upward air current from the windward side. When I ask seafaring men about the matter, they at first say confidently that the birds sail on either side of the ship, but after a little consideration they waver in this statement and admit that they have never taken particular note of the facts in the case. Accordingly I have thought it worth while to write this letter, in the hope that its publication in NATURE, if room be found for it, may stimulate further observation of an interesting phenomenon and perhaps prevent some inventors from wasting their time and money in vain attempts to accomplish motorless flight.

The westward course from Queenstown may be an especially favourable place for studying the question here raised. Four years ago I made there some observations which, so far as I can now recall them, agreed in essential particulars with those which I have made recently, but I did not at that time see the full significance of the facts noted.

EDWIN H. HALL.

Cambridge, Mass., September 20.

Errors of the Computed Times of Solar Eclipse Phenomena.

THE final reports of two of the observers of the total solar eclipse of April 28, 1911, have recently been published, giving detailed accounts of their experiences at Vavau, Tonga Islands. Father Cortie's report appears in Proceedings, R.S., No. A595; that of Dr. W. J. S. Lockyer in a publication of the Solar Physics Committee. In reading these reports I have been much struck by the circumstance that both writers appear to have been taken aback by the (to them) unexpected effect of the errors of the lunar tables on the computed times of the various phases of the eclipse. But I wish to point out that they were not left without warning. In Monthly Notices, R.A.S., vol. lxix., p. 31, I stated that with the existing errors of the lunar tables the times of the contacts in this eclipse as there given would be several seconds too late. And as a means of estimating the true times I gave the intervals from the instant when the cusps subtended an angle of specified value at the sun's centre to the commencement of totality. The shift of the moon's actual position relatively to its tabular place would, of course, alter the predicted duration of the eclipse. At the time of publication of my paper (November, 1908), it was not possible to give definite information as to the magnitude of the errors in question, as Newcomb's latest corrections were not then available. But, so far as appears from these reports, the intending observers did not make any further inquiries on the subject before proceeding to draw up their definite programmes of observation. In the circumstances this, surely, would have been a wise precaution.

A. M. W. DOWNING.

September 27.

WITH regard to Dr. Downing's remarks, I was aware from his published statement that the predicted time of totality would probably be "several seconds too late," but little thought that the error would amount to so much as *twenty seconds* of time. The precaution was naturally taken to observe closely the diminishing cusp and to arrange to give the necessary time signals from the cusp data mentioned by Dr. Downing in the above letter. Unfortunately, however, while the cusp was visible nearly up to second contact, the image of it on the screen had been oscillating so violently (due to air tremors) that the officer in charge had previously decided to give the necessary signals at the computed times from the chronometer. (See page 17 of my report for details of the actual procedure.) It is true that no inquiry was made by me to find out what error might be expected, but it was assumed that if such a large error had been approximately known it would have been published. It would be advantageous if the present director of the Nautical Almanac could find his way to make generally known the approximate values of such errors a short time previous to the setting out of eclipse expeditions.

The facts that Father Cortie's camp was in the same clearing as that of my party and that he made use of my time signals explain why he experienced the same error.

WILLIAM J. S. LOCKYER.

Solar Physics Observatory, October 1.

A Flower-sanctuary.

IT seems to me that Sir Edward Fry takes a rather narrow view of the by-law under discussion; for surely it may be held that the removal of any of the special Cheddar plants, in such quantities as to leave a blank where there was formerly a mass of colour, would constitute a "disfigurement" or "damage" within the meaning of the enactment: and I suggest that any bench of magistrates anxious to preserve the beauty of the gorge should find no difficulty in convicting under the by-law. If, however, it be held that the existing by-law is inadequate, it seems clear that county councils have full power to enact far more stringent and specialised by-laws.

I remember that on the commons under the jurisdiction of the London County Council there used to be—and doubtless still are—notices forbidding anyone, under a penalty of five pounds, to pluck even a single blossom of any wild flower; and I think that Sir Edward Fry will find on St. Vincent's Rocks, at Clifton, notices announcing a similar penalty against anyone who shall gather the rare *Arabis stricta*: at any rate, there were such notices a few years ago,

[1] Perhaps F should be taken in the direction of D, but uncertainty here does not affect the main argument.

and it was well understood that the protection of *Arabis stricta* was the motive, or a chief motive, of the authorities. FRANK H. PERRYCOSTE.

Higher Shute Cottage, Polperro, Cornwall, September 29.

MR. PERRYCOSTE is quite right in suggesting that the special flora of Cheddar might be destroyed in such a way as to bring the offender under the by-law in question, but this does not interfere with my statement that the flora might be destroyed without any contravention of the by-law; it is much more probable that the flora will be gradually extinguished than by a single act of vandalism. EDW. FRY.

IN addition to the existence of a local order for the protection of wild flowers in Cornwall, extending only to the highways, there are other counties, such as Essex, Surrey, Sussex, and Devon, that have already availed themselves of the power to frame a by-law applying to a separate county.

Though these means of restricting hawking and excessive collecting exist on a limited scale at present, it is the aim of the Plant Protection Section of the Selborne Society to obtain the cooperation of all county councils in the framing of by-laws throughout the country. This, indeed, it must be stated, is apparently the only course left, for the experience of county councils in applying singly for this power to the Home Office has been distinctly discouraging. In fact, the Home Office has refused to increase the number of local orders; so that the only method to adopt is to get every county council to apply simultaneously, when the force of public opinion thus expressed will not fail, we hope, to have the desired effect.

Of course, the securing of a local order for Somerset, as advocated by Sir Edward Fry, would not be equivalent to the establishment of a flower-sanctuary. Unless land were purchased by the National Trust, or some kindred public-spirited body, or by private enterprise, the making of a reservation of any tract without the owner's consent is out of the power of the Government. At least, we have not come to land nationalisation as yet (save the mark!).

The desirability of the formation of wild-flower reservations is undeniable. It is one of the projects kept in view by the Plant Protection Section. One of the methods of securing this end will be the obtaining of the support of the scientific societies of the country, and the appointment of a corresponding secretary in each district to advise upon what tracts require reservation and what facilities exist locally for their formation. The writer's investigation into the voluminous causes of extermination of plants has shown that there are numerous localities in every county of the British Isles which require reservation or protection. It is obvious that no one body such as the Selborne Society could undertake to carry on single-handed the enormous amount of organisation required to protect actively plants locally without effective assistance from such bodies, or without some organised effort. This question is on the *tapis* at the next meeting of the section, which I hope Sir Edward Fry will attend, and it is hoped to prosecute this part of the campaign very actively during the coming winter. The assistance of any who can render service in this matter of enlisting the sympathies of the scientific societies will be very gratefully received. The result of an appeal to the county councils last year to aid in the creating of a public protest against exterminating wild flowers, especially addressed to the schools, in which the collecting necessary to the pursuit of nature-study was involved, was very encouraging.

The whole question resolves itself, in fine, to the obtaining of State protection of wild plants (and animals) in this country, as in Prussia. This is the prime object the section has in view. In the meantime, it is endeavouring to create a public opinion in favour of the movement, until such time as the occasion is ripe for making a concerted appeal for Government control. A. R. HORWOOD,

Recorder, Plant Protection Section of the Selborne Society.

Leicester Museum, September 27.

The Summer of 1912.

IN NATURE of September 19, Mr. Harding concludes a very interesting article on the recent summer in the British Islands, by recording the fact that "the temperature of the sea-surface in the North Atlantic and in proximity to our own coasts has for some time past been much below the average." This seems to bear out what I have been telling people for weeks past—that the abnormal chilliness of the past summer, and especially of the month of August, was in all probability due to the cooling of the Gulf Stream by the abnormal ice-drift on the other side of the Atlantic, to which the disastrous fate of the *Titanic* forced the tardy attention of even the great shipping companies. A reference to such a thorough-going atlas as that of Diercke and Gaebler (p. 21) will show what this must mean, when not only icebergs but extensive icefloes in such numbers were melting away in the latitudes of the Spanish peninsula, and even further south than the latitude of Gibraltar, in the very path of the Gulf Stream Drift, and even of the return North Equatorial current, with the natural result that these islands, within the same latitudes as Labrador, should have a taste of something like a Labrador summer.

If we make a little scientific use of the imagination, asking ourselves what would be the climatic results to north-western Europe of the obliteration of the Gulf Stream altogether, we may arrive at some inferential results as to the importance of such a causal factor among the conditions which existed in the Pleistocene period of glaciation, when—as Prof. J. W. Spencer (Bull. Geol. Soc. America, vol. vi.) has shown—the elevation of the Antillean Continent was such that we may infer the impossibility of the existence of the Gulf Stream as such for the greater part of that period.

That would leave us no more than such a mere *wind-drift* of surface ocean-water as is seen in the "Kuro-Siwo" of the North Pacific at the present time (*op. cit.*, p. 13). See further, Tarr, "Physical Geography" (pp. 182–191) and "The International Geography" (p. 69), both published by Messrs. Macmillan and Co. A. IRVING.

Hockerill, Bishop's Stortford, September 30.

Turkish Earthquake of September 13.

THE bulletin from Pulkowa has just reached me, and from this it appears that the azimuth of the epicentre from Pulkowa was 9° 12′ west of south. Two estimates of the distance are given, leading respectively to 41·1° N., 26·4 E., and 40·1° N., 26·3° E. The epicentre determined here was 40·4° N., 26·9° E., and the azimuth was 65° 33′ east of south.

From the two azimuths alone I find the epicentre to be 40·7° N., 26·5° E. GEORGE W. WALKER.

The Observatory, Eskdalemuir, Langholm, Dumfriesshire, October 1.

THE NORTHERN ELEPHANT SEAL.

A VALUABLE paper on the northern elephant seal (*Macrorhinus angustirostris*, Gill), by Mr. Charles H. Townsend, director of the New York Aquarium, has been published in "Zoologica"—scientific contributions of the New York Zoological Society—vol. i., No. 8. The paper is No. 2 of the scientific results of the expedition to the Gulf of California, in charge of Mr. Townsend, by the U.S. Fisheries steamship *Albatross* in 1911. It consists of fourteen pages, accompanied by twenty-one illustrations, and relates to a species concerning which there has been comparatively little information obtained during the past forty years.

The northern elephant seal has long been on the verge of extinction, and is now found only on Guadalupe, an uninhabited island lying in the Pacific Ocean 140 miles off the northern part of the peninsula of Lower California. It formerly had a range extending for about 1000 miles along the coast of Upper and Lower California, and has never been recorded from any other region of the north Pacific. It is the largest of all seals, and owes its name to its great size and to the remarkable snout or proboscis developed in the adult male.

Being valuable for its oil, the seal was killed in large numbers for commercial purposes as late as the year 1852. Since then it has seldom been seen. During the winter of 1911, while in charge of the deep-sea investigations of the United States steamship *Albatross*, Mr. Townsend called at Guadalupe Island and was fortunate enough to secure the specimens, photographs, and data upon which the present paper is based. In addition to the museum specimens obtained, six yearlings were shipped alive to the New York Aquarium.

The seals had little fear of man. While the large specimens were being skinned and skeletonised, some of the animals slept undisturbed within thirty feet of where the men were working. A few of the females were accompanied by newly born pups, indicating that the breeding season was just commencing. The author did not observe any male with more than one female.

The three adult males which were killed were found to have an average length of sixteen feet, with a girth of eleven feet. The adult female obtained was eleven feet long. The new-born pups were distinguishable in colour from the yearlings, being dusky black, and were apparently about a week old (March 2). The colour of the adult is yellowish-brown, the young animals being greyish-brown.

The skin of the adult male is very thick, and the carcasses were so heavy that it required all the strength of half-a-dozen men to turn one of them over. Unless actually annoyed by members of the party, the animals did not attempt to leave the beach. The large males that accompanied the nursing females were frequently engaged in fights with unattached males. There had evidently been considerable fighting, as their necks were more or less raw.

In fighting, the large males crawl slowly and laboriously within striking distance, and then, rearing on the front flippers, and drawing the heavy, pendant proboscis into wrinkled folds well up on top of the snout, strike at each other's necks with their large canines. The skin of the under surface of the neck and fore-part of the breast is greatly thickened; it is practically hairless, and years of fighting give it an exceedingly rough and calloused surface. This *shield*, as it may be

FIG. 1.—View of north end of elephant seal rookery, Guadalupe Island. Males, females, two-year olds and yearlings. The males with heads erected are in fighting attitude, with proboscis retracted and mouth wide open. U.S.S. *Albatross* in distance.

called, is the part of the animal most exposed to attack when fighting. The proboscis is broad and fleshy to the tip, and its length forward from the canines is about equal to the distance between the canine and the eye. It is exceedingly thick and heavy, and its width is about equal to the space between the eyes. In one specimen taken, it was nine inches long. When the animal is crawling, the proboscis is relaxed and pendant.

The author found that the proboscis is not capable of inflation. When withdrawn, it is simply massed into compact folds on top of the head. There is little indication of the proboscis in the half-grown male, and it is probable that it does not develop until sexual maturity is reached.

The specific distinctness of the northern elephant seal is well shown in photographs of the skulls of *Macrorhinus angustirostris* and *M. leoninus*, the skulls of both species exceeding twenty-two inches in extreme length, *angustirostris* being longer, while *leoninus* has the greater zygomatic width.

Mr. Townsend has directed the attention of the Mexican Government to the existence of this unique herd, and the Mexican authorities have already taken steps to prevent its destruction.

FIG. 2.—Male elephant seals approaching to fight. When within striking distance, both rear high on fore flippers, retract proboscis and open mouth very wide.

THE NATURAL HISTORY OF THE DEAD SEA AND JORDAN VALLEY.[1]

IN the volume before us Dr. Blanckenhorn has collected the results of his researches into the geology and natural history of Palestine, the latest of which occupied the first half of 1908. These have enabled him to give a much more minute account of the geology of the region than any of his predecessors, to lay down more accurately the boundaries of the several formations, and to trace a number of important faults. As his map shows, the Syrian upland on either side of the Jordan valley from the southern end of the Dead Sea almost up to the Lake of Gennesaret consists of Cretaceous rocks chiefly of Senonian and Turonian age, with an occasional exposure of the underlying Cenomanian.

At the beginning of the Senonian were slight and local volcanic outbreaks, and this formation is sometimes bituminous. Marine deposits of Eocene age are first seen on the west side of the Jordan about the latitude of Jaffa, and become more extensive in proceeding northward. No marine beds of Miocene or Pliocene age occur in the hill country; the deposits in the Jordan valley are mapped as *diluvium* (when will foreign geologists abandon this discredited and misleading term?), and the latest therein, with those in the Kishon valley and on a large part of the coast, are "alluvium." Then came the volcanic discharges which built up the great basalt mass of the Hauran with the minor outbreaks west of the Jordan, which are obviously subsequent to the formation of its valley. On a separate sheet Dr. Blanckenhorn exhibits in a tabular form (very convenient to the reader) his conclusions in regard to the dates of the later movements and deposits, and their correlation with those in Europe. According to this, a continental elevation, causing a steeping of the general slope and the first great erosion-phase of the rivers, began about the middle of the Pliocene. Dr. Blanckenhorn places the second phase of earth movements, bringing about the first fractures running from north to south,

[1] "Naturwissenschaftliche Studien am Toten Meer und im Jordantal: Bericht über eine im Jahre 1908 unternommene Forschungsreise in Palästina." By Prof. Max Blanckenhorn. With geological map in colours, 6 plates from photographs, and 106 figures in text. Pp. vii+478. (Berlin: R. Friedländer & Sohn, 1912.) Price 17. 4s.

i.e., the trough faulting which gave rise to the Red Sea and the Gulf of Akabah, the Wady Arabah and the Jordan valley, at the beginning of the Pleistocene, and with this he associates the great basaltic discharges already mentioned.

A large fresh-water lake was next formed in the Jordan valley, which he considers to be a record of a pluvial phase and contemporaneous with the Günz glaciation of the Alps. Towards the end of this began a third epoch of earth movements, producing some folding and faulting in a north to south and north-north-east to south-south-westerly direction and bringing up some older strata, among them probably the Cambrian, which he discovered south of the Dead Sea. These caused some more eruptions. A short dry period followed, in which the level of the lake was lowered, the water became brackish, and the salt beds of Jebel Usdum (the top of which is about 600 feet above the present level of the Dead Sea) were deposited. This corresponded with the first interglacial phase of the Alps. The Mindel glaciation of that region brought on a pluvial phase in Palestine when the Jordan valley-lake was at its greatest, extending from the north of the Lake of Gennesaret to some distance south of the Dead Sea, and small glaciers formed in the Lebanon. A long dry phase succeeded, corresponding with the second interglacial of the Alps, during which the Jordan lake sank nearly to the present level of the Dead Sea; all the valleys were much eroded, and some streams of lava (the last in this region) were ejected.

The Riss ice age of the Alps (that when the glaciers attained their greatest size) corresponded with a third pluvial phase which produced the middle terraces in the Jordan valley. The lake again retreated in another dry period, representing the third interglacial of the Alps, but the lower terraces in the Jordan valley are records of the Würm glaciation, after which the climate gradually changed to its present condition. Valley erosion went on throughout, and an elevation of the coast occurred just before the Würm ice age. This, according to Dr. Blanckenhorn, corresponds with the Mousterian, Aurignacian and Solutrian ages of man, the Chellean and Acheulean being placed in the preceding interglacial phase and the earliest of our forerunners at present acknowledged (the Reutelian) being regarded as contemporaries of the glaciers of the Lebanon.

The tabulation is undoubtedly a neat one, but it does not seem clear how Dr. Blanckenhorn explains the separation of the Dead Sea (and the greater part of the Jordan valley) from the Gulf of Akabah. The watershed between these is about 700 feet above the latter and is suggestive of movements transverse to the Jordan-Akabah trough. It is also singular that the period of greatest cold in Palestine—that of the Lebanon moraines—should correspond with the Mindel glaciation of the Alps, and that both the times of heaviest precipitation should be contemporaneous with the two smaller advances of the Alpine ice and not with the two greater, the Riss and the Würm. It is, of course, possible that the zone of heaviest precipitation did not shift southward with that of lowest temperature, but some explanation, we think, might have been offered of this rather obvious anomaly.

Perhaps also scepticism may be still permitted as to some of the subdivisions in the relics of primitive man, and even the identification of the earliest among them, but this we know is thorny ground.

The book, we think, would have been improved if the author, instead of retaining the form of a diary, had been content to give his itinerary in the fewest possible words and to group together his results so as to give continuous accounts of the stratigraphy and of his views about the physical geology, with the reasons for them. The reader at present loses his way in the mixed multitude of personal and scientific details, and perhaps sometimes fails duly to appreciate the latter. The illustrations also leave something to be desired, the sketches of sections generally being very rough. Still, Dr. Blanckenhorn has spared no pains in collecting a great quantity of information on the geology of Palestine, besides giving lists of the fauna and flora of the country, so that his book will be a very valuable addition to our knowledge of that interesting region.

T. G. B.

THE MEDICAL NEW YEAR.

ON October 1, our medical schools begin their winter session; and in many of the chief medical schools this New Year's Day is observed by giving a ceremonial address to students and others. This good custom shows some signs of old age. The need is less than it was that medical students should be warned against idleness, off-hand manners, or unkindness. The introductory address tends to have an old-fashioned air; and, it may be, the time is coming for some kind of ceremony more in accord with our present ways. The like embarrassment seems to attend the annual orations in praise of Harvey and of Hunter at the Royal Colleges of Physicians and Surgeons of England. Harvey and Hunter, we begin to think, would be glad to know that their immortal names were given a rest, in favour of the praises of some of their successors.

Still, one would be sorry that the First of October addresses should be abandoned at our medical schools. The reports of some of them, published last week in *The Lancet* and *The British Medical Journal*, are of notable interest, and cover a wide range of thought.

At St. George's Hospital, Mr. Grimsdale spoke on the present duty of the medical citizen; and the very phrase "the medical citizen" tells how far we have come from the old professional individualism of the doctor. Imagine the feelings of the physicians of King George III. if they had been told they were medical citizens. Still, there was no National Insurance Act in those not very spacious times; and Mr. Grimsdale was mostly

concerned with the National Insurance Act. He put clearly and well the reasons why the doctors cannot and will not work under the Act as it stands at present; and the doctors will be glad that he reminded them of that delightful fable of the elephant and the partridge's nest.

At the Middlesex Hospital, Dr. Lazarus-Barlow chose a very different theme—the genius of the infinitely little. Why genius? Whatever attributes we may be able to assign in our imagination to the infinitely little, genius is not one of them. He ought to have said the kingdom, or the work, of the infinitely little. But he gave an admirable address. It was Pasteur, of course, of whom it was said that he had discovered the kingdom of the infinitely little. But, as Dr. Lazarus-Barlow told his audience, beyond the kingdom of the bacteria there is the kingdom of the radium emanations, which are infinitely littler; and beyond the kingdom of the radium emanations there is the kingdom of the enzymes, which are infinitely littlest. Not thought, but wonder alone, is possible in the presence of the facts of these kingdoms. It takes a very metaphysical mind to be near them.

With a sort of shock we come to Dr. Jane Walker's address to the London School of Medicine for Women. Her theme was common sense. It is a fertile subject for a medical address, and she treated it with delightful simplicity and directness. She began with those two prophets without honour in their own country, MacCormac of Belfast, and Boddington of Sutton Coldfield, who advocated the open-air treatment of consumption when as yet there was no clear understanding as to the cause and the nature of that disease. Next she praised, for the splendour of their common sense, St. Francis, Ambroise Paré, and Dr. Johnson. We think that St. Francis would rather be excused; and Dr. Johnson, like the doctors in the line "Who shall decide where doctors disagree?" was not a medical doctor; but Ambroise Paré is all right; his common sense is magnificent and unfailing. Dr. Walker gave many other pleasant and memorable examples of the sovereignty of common sense in the wisdom of life. It may be permitted to quote one out of many.

> Take the case of the "mentally defective" problem. Are we not just a little lacking in common sense in our dealing with that? Surely our attention ought to be more earnestly directed to the so-called normal people, that they do not tempt their feebler brothers and sisters, who, left alone, would do them little harm. When one reads the flood of literature that is constantly being poured out about the "menace of the feeble-minded," one is tempted to feel that a good deal of it is mere nonsense.

Indeed, we hope that all the women students who heard Dr. Walker's lecture will follow her good advice; and it is a good thing for our lady doctors in this country that they have this keen eye for the importance of common sense in medical and surgical practice.

Dr. Humphrey Rolleston's address at Manchester University is perhaps the best of all in regard to thoroughness and careful weighing of his words. He took for his subject "Universities and Medical Education." As a Cambridge man, who is likewise an examiner in Manchester University, he was able to speak with authority of the complex and ever-shifting relations between all that is called Literæ Humaniores, the medical sciences, and medical and surgical practice. It would be hard to beat his ideal of the first years of medical education.

> The education best suited for a medical student before beginning his professional subjects should be on the following lines. The subjects ordinarily taught in schools, including Latin and Greek, should be pursued until the age of about 15½ years, when the student's proficiency should be tested by an examination, the results of which should count at the university matriculation. After passing this examination the student should spend the next 2—2½ years in obtaining a sound knowledge of French and German, literature, English composition, physics, and chemistry, and the necessary mathematics. At the end of this time, when he is from 17½ to 18 years of age, he should be able to pass an examination on these subjects, and then begin the study of biology and of anatomy and physiology. This compromise would ensure general culture with a modicum of classical training, and a knowledge of French and German at a time when it can be readily acquired, and yet would not encroach unduly on the time necessary for strictly professional instruction. This education, which is somewhat on the lines provided on the modern side, would be far better than that given on the classical side at public schools, and by providing a good basis of physics and chemistry would do much to remedy the prevailing difficulty of the early science examinations in the medical curriculum.

While introductory addresses remain as good as these four, it would certainly be a pity to desert this way of observing the opening of our medical schools.

THE CHURCH CONGRESS AT MIDDLESBROUGH.

DURING the week ending on Saturday, October 5, the Church Congress has been holding its annual gathering at Middlesbrough, the great industrial centre of population which has grown up at the mouth of the Tees. The choice of such a meeting-place is at once a declaration and a challenge—a declaration that the Church considers the problems of industrialism to be also the problems of religion, and a challenge to those people who would solve the riddles of capital and labour without reference to a spiritual basis for the aspirations of both parties in the conflict. It is well that any body of men and women joined together to discuss the outstanding difficulties of a common faith should feel able at times to dispense with the inspiration of mediæval architecture and academic hall and should go forth boldly to conduct their deliberations on the edge of a populous and rapidly depleting coal-field, illuminated with the glare of titanic blast furnaces.

On the whole, the choice of subjects and their treatment by the selected speakers has justified

the action of the organising committee. We do not look to such meetings to produce any contribution to knowledge, but rather to express an attitude of mind and to set an example of a right method of approach to the vexed questions of the day. The eminently sane and statesmanlike influence of the Archbishop of York was felt throughout the proceedings, and his opening address contained an excellent summary of the ground to be traversed in these meetings of the Congress, and indicated the point of view from which he desired that it might be surveyed.

The papers and discussions on town planning and rural housing showed signs of a healthy realisation of the economic aspects of that question. Cottages never will and never ought to be built in any number and let at rents less than their true economic value. Such a course of action, from whatever motives it be adopted, leads in the end to a depreciation of wages. It is, in fact, a return by a circuitous route to the old and evil plan of a subsidy to wages through a widespread extension of a method of outdoor relief—a system which, under the old ante-1834 Poor Law, proved to be pauperisation in one of the worst forms. Only when it is realised that, as Mr. Raymond Unwin declared was already the case, it pays to provide good housing accommodation and that garden villages are a better form of investment than potential slums shall we see the end of the long series of lamentable mistakes in housing, some of which have recently been perpetrated afresh in connection with the opening up of the new industrial areas at Doncaster and Dover.

The question of the falling birth-rate, a fall which is very marked in the manufacturing cities of the northern provinces, wherever women are employed in factories, was dealt with by Mr. W. C. D. Whetham, F.R.S., who again emphasised the frequent opposition in present circumstances between the economic and the religious aspect of normal family life. The Church of England, unlike the Church of Rome, has not yet grasped the fact that the number and quality of her future members, indeed, her very corporate existence, can be made the plaything of social, industrial, and moral forces with which she has neglected to concern herself.

From the academic point of view, the most interesting morning was that devoted, on Thursday, to a discussion of the relation of miracles to the Christian faith, a contribution towards the age-long effort to reconcile intuitive belief and intellectual reason and to assign to each their true importance in the religious life. The subject was opened by the Dean of Christ Church (Dr. Strong) with an admirable attempt to determine how far, in the light of all knowledge at present available, it was practicable to answer the question: "Are miracles possible at all?" The Dean gave an excellent account of modern thought relating to the purely mechanical theory of life, which would regard the world as a closed system, controlled by unerring laws of matter and motion, and in which the appearance of a miracle could only be explained as the result of imperfect observation or incorrect deduction. But he pointed out that recent tendencies, both in philosophy and biology, would seem to lead away from and not towards the acceptance of such a mechanical view of nature as the complete and ultimate solution of the whole problem of existence and consciousness.

Prebendary Webb-Peploe's contribution, which was much applauded, served to remind us that for those people who are prepared to adopt intact into their theological belief the experiences attributed to Job, Daniel and Jonah, the efforts of learned professors and others to alleviate their lot are both officious and ill-judged. The discussion was closed by the Archbishop, who referred to some of the papers read at the recent meeting of the British Association for the Advancement of Science, held at Dundee, and concurred with the Dean that at the present moment it was the mechanical theory of the universe, quite as much as the miraculous basis of Christianity, that was on its trial in the world of thought. His Grace's closing sentences, as reported in *The Times*, may perhaps be given to sum up the general trend of the whole discussion. "The real meaning of the miraculous was that it was an assurance given to them that, ultimately, the Divine Being was free and master in His own house; and it was the coming forth of that fact into the world that carried with it the consequences that they called miracles."

NOTES.

THE meeting to be held at the Mansion House on October 23, in connection with the proposed memorial to the late Lord Lister, is the outcome of a movement which was set on foot by the presidents of the Royal Society and the Royal College of Surgeons. A large and influential committee has been formed, representative of scientific, medical, and general interests, both in this country and abroad, and the various possible schemes, including a memorial in Westminster Abbey, and others of an international character, will be laid before the meeting, which it is hoped will be largely attended.

THE Royal Microscopical Society has arranged to hold a conversazione at King's College, London, on Wednesday, October 16, from 8 to 11 p.m.

THE extension to the Manchester Museum will be opened on the afternoon of Wednesday, October 30, by Mr. Jesse Haworth. An address will be delivered by Prof. W. M. Flinders, F.R.S.

MR. E. GRANT HOOPER, superintending chemist, Government Laboratory, and vice-president of the Society of Chemical Industry, has been appointed Deputy-Government Chemist, in succession to Mr. H. W. Davis, who has retired.

SIR GEORGE DARWIN, K.C.B., F.R.S., Plumian professor of astronomy at Cambridge, who, we regret to learn, has been ill for two or three weeks, underwent a severe operation on Thursday last. On Sunday he spent a bad night, but we are glad to be able to state that he is now making good progress.

THE Home Secretary has appointed a committee to inquire and report as to the precautions necessary in the use of celluloid in manufacture and the handling and storage of celluloid and celluloid articles. The members of the committee are:—The Earl of Plymouth (chairman); Prof. J. J. Dobbie, F.R.S., principal Government chemist; Captain M. B. Lloyd; Mr. H. M. Robinson, Deputy Chief Inspector of Factories; and Mr. E. O. Sachs, chairman of the executive of the British Fire Prevention Committee.

WE notice with regret the announcement of the death on Sunday, October 6, at seventy-six years of age, of Prof. W. W. Skeat, professor of Anglo-Saxon in the University of Cambridge, and of world-wide distinction among philologists. In his early years he showed talent in mathematical studies, and he took his degree at Cambridge in the Mathematical Tripos, where he was placed as fourteenth Wrangler in 1858. After a few years spent in country curacies, he returned to Cambridge in 1864, and was appointed a mathematical lecturer at his own college, Christ's. He then commenced the etymological studies represented in the long series of publications upon the English language which forms an imposing monument to his knowledge and industry.

THE third International Archæological Congress was opened in Rome on Wednesday, October 9. We learn from *The Morning Post* that no fewer than twenty-four Governments are officially represented, but the British Government is absent from the list, though one department—the Board of Education—is represented by Dr. Ashby, the resident director of the British School at Rome. British universities and other learned societies, however, are well represented. The congress will be divided into twelve sections, according to subjects. Among the themes to be discussed are:—The Iron age in Italy, the prehistoric civilisation of Sardinia, the monuments of Egypt and Asia, Minoan civilisation, the origins of Etruscan culture, the territories of the old Italian cities, Roman epigraphy, numismatics, the roads of the Roman Empire, and the question of archæological bibliography.

AN interesting and important step towards systematised nature-protection has been taken by the Royal Society for the Protection of Birds. This is the taking over of the remarkable Somerset headland, Brean Down. For permission to establish this sanctuary the society is indebted to the wisdom of the Somerset County Council, the action of which may well form a precedent for county councils throughout the kingdom. The society has the "shooting rights," and has appointed a watcher, but the general maintenance of the place will depend largely on the support given to the society. Subscriptions for this or other work of the society may be sent to the secretary, 25 Queen Anne's Gate, S.W. The joint action of local governing bodies, of protection societies, and of private individuals is the kind of method that should succeed in this country. "Our Dumb Friends' League" will hold a meeting at the Whitehall Rooms on October 15, at which Mr. James Buckland, the promoter of the Plumage Bill, Colonel Sir Mark Lockwood, M.P., and Mr. George Greenwood, M.P., will speak. The Ranee of Sarawak will preside. Brean Down is a bare grassy promontory with broken cliffs. It is well known to botanists as a habitat of the white rock rose. Its chief bird—there are three specially protected—is the beautiful sheldrake. Of the other two, the raven has built here for fifty years. Lately the peregrine, so often found near the raven, has established itself. Mr. Harry Cox, to whose zeal the new sanctuary mainly owes its institution, last year rescued the only young one. Kingfishers, sparrow-hawks, daws, kestrels, shrikes, linnets, rock-pipits, and wheat-ears are also natives.

THREE important plaster casts have been added to the exhibition of fossil reptiles in the department of geology in the British Museum (Natural History). A copy of the skull of the gigantic carnivorous dinosaur, *Tyrannosaurus rex*, is interesting for comparison with the fragmentary remains of Megalosauria found in England. The original specimen was obtained by the American Museum of Natural History from the Upper Cretaceous (Laramie Formation) of Montana, U.S.A., and as it measures no less than 4 ft. in length, the carnivore to which it belonged would be able to prey on the contemporaneous herbivorous dinosaurs, Trachodon and Triceratops. A copy of the skeleton of a pterodactyl, with large slender teeth, lately discovered by Mr. B. Hauff in the Upper Lias of Würtemberg, shows again how completely developed were the flying reptiles even in the early part of the Jurassic period. A cast of a nearly complete skeleton of the Permian labyrinthodont, *Archegosaurus decheni*, in the museum of the Prussian Geological Survey at Berlin, is a useful acquisition in view of the researches now in progress concerning the origin of reptiles and their connection with amphibians.

BY the tragic death of George Herbert Grosvenor, who was drowned at Polzeath on September 4, whilst endeavouring to save the life of a friend, biology has lost one of the most promising of her younger workers. After a brilliant career at Harrow, Mr. Grosvenor was elected to a biological exhibition at New College, Oxford, subsequently taking a first in his Final School. Elected to the Oxford table at Naples, he confirmed, by a brilliant piece of work, Strethill Wright's almost forgotten suggestion that the nematocysts of Æolids were derived from their prey. His work was awarded the Rolleston prize in 1904. On his return to Oxford he became busily engaged in founding a new school of economic entomology, and with his characteristic thoroughness had acquired a wide knowledge of insects. His regular work left him but little time for research, though it is hoped that the results of some of his investigations may yet be published. Of his great personal charm this is not the place to speak. He combined an exceptional power of concentration and clearness of thought with a singularly modest and retiring disposition, and his loss will be long and deeply felt by those whose good fortune it was to be his associates.

THE statue of Captain James Cook presented to the town of Whitby by the Hon. Gervase Beckett, M.P., which was unveiled on October 2, will be welcomed

as a fitting memorial to a man who succeeded, where many others had failed, in laying open the secrets of the Pacific Ocean, thanks mainly to inborn determination and courage. Cook was not a man of many or varied attainments. He was born of lowly parents, and from his earliest years his whole energy was directed towards perfecting himself in the work of his calling on the sea. The same energy and stedfastness of purpose, joined to his temperance and his mastery of every detail of his profession, enabled him to carry through the journeys which elucidated the questions as to the amount and extent of the lands in the Southern Ocean, the answer to which had eluded so many less competent and persevering explorers. It is on his work as a voyager and discoverer that Cook's chief claim to fame is based, but the fact that he was the first to take scientific preventive measures against scurvy, the disease which has wrecked the hopes of so many explorers, earned him the gratitude of voyagers. It was for his splendid work in this direction that he was unanimously elected a fellow of the Royal Society after his return from his second voyage in 1775. On this he had kept the sea for three years, and but one of his crew of 118 men was lost.

IN the report of the Rhodesia Museum—which is now under the joint control of the Bulawayo municipality and the Rhodesia Scientific Association—for 1911, it is stated that the building opened by H.R.H. the Duke of Connaught in 1910 is already well-nigh filled, and that proposals for enlargement are already under consideration. There is the usual complaint as to the insufficiency of funds, even for ordinary purposes.

THE hundredth volume of the *Zeitschrift für wissenschaftliche Zoologie* was completed with the part published on June 25 last, and already three parts of the hundred and first volume have appeared since that date. The degree of elaboration to which it is possible to bring the study of invertebrate anatomy is well illustrated in recent volumes of this valuable series. The last part issued (vol. ci., part 3) contains the first continuation of the fifth part of Dr. Friedrich Voss's memoir on the thorax of the domestic cricket, and this continuation alone contains no fewer than 134 pages. Truly the accumulation of detailed information with regard to the animal kingdom goes on at a great rate, especially in Germany.

CANADA, it appears from the report of the Commissioner of Dominion Parks for 1911, published by the Government Printing Bureau at Ottawa, now possesses seven public parks in which native animals are preserved. Some of these, which contain hotels and medicinal baths, are to a great extent self-supporting, and all are stated to be making rapid and satisfactory progress. In the Rocky Mountain Park at Banff, where the use of firearms, save in exceptional circumstances, is prohibited, the animals are becoming increasingly tame, deer visiting the lawns of the residences, and bighorn sheep wintering within half a mile of the Pacific Railway. The bison (buffalo) in the Buffalo Park at Wainwright are in a thriving condition, and promise a large natural increase in the future.

THE last report of the Madras Museum records steady progress in the arrangement of this important collection and in the acquisition of new specimens. The great series of bronze images has been re-classified, and a considerable number of fresh copper plates has been added. The numismatic department has received large additions in the shape of pagodas, fanams, and six Venetian sequins. Among the accessions to the natural history collections may be mentioned the first Indian specimen of Swinhoe's snipe (*Gallinago megala*), shot recently in the Chingleput district, a bird which breeds in Eastern Siberia and Northern China, and migrates in the cold season to Southern China and the Malay Peninsula, the few existing specimens having been procured from the Malay Peninsula, Burma, and Assam.

IN the August number of *The National Geographic Magazine*, Mr. Carl E. Akeley narrates, with a great wealth of photographic illustration, his experiences during an expedition to East Africa for the purpose of obtaining a series of elephants to form a group in the American Museum of Natural History. The main note of the article is the growing scarcity of old bulls with tusks of more than 50 lb. in weight. The best specimen obtained was a young bull standing 11 ft. 3 in. at the shoulder, with tusks weighing respectively 100 and 102 lb. These tusks were comparatively young ivory, and it is estimated that if the animal had been suffered to live another fifty years it would have developed tusks of something like 200 lb. weight, such tusks being by no means abnormal, but merely the ordinary development of mature bulls of the Uganda race. When, however, a bull grows tusks of 50 lb. weight, which he does in about twenty-five years, he becomes the target of every hunter in the country, and it is consequently only a few individuals, which obtain protection by living amid large herds of cows or in dense forests, that can attain full maturity. Large tusks must therefore become very rare in the near future. Attention is also directed to the damage to forests and cultivation due to herds of elephants from which tuskers have been killed off, damage which may lead to reprisals from proprietors as the country becomes opened up.

THE forty-third annual report of the American Museum of Natural History for the year 1911 begins by recording that the trustees have resolved to complete the building of the southern half of the museum in time for the celebration of the jubilee in 1919. Special halls will thus be provided for whales, fishes, oceanography, and geography, while numerous rearrangements for the more adequate display of the collections will be possible. With characteristic energy, and with the aid of private benefactions, the museum employed no fewer than forty-four parties for the collection of specimens in various parts of the world. It is, therefore, making haste to rival in opportunities for natural history research the older foundations, the growth of which has been more gradual. Among notable accessions thus obtained during 1911 may be

mentioned mammals and birds from Lower California and the northern part of South America, invertebrates from the West Indies and British Guiana, fossil mammalian remains from Cuba, and a glacial pot-hole from St. Lawrence County, New York. The Williston collection of tropical Diptera was also purchased. Among new exhibits illustrated in the report, the group of skeletons of extinct ground-sloths from South America is especially important, while a set of restored models of Devonian fishes arranged in the form of an aquarium is at least striking. Probably on account of the intimate association of the museum with elementary education, most of the exhibits seem to be more pictorial in character than those to which we are accustomed in European museums. The American museum is to be congratulated on being able at the same time to occupy a foremost place in the advancement of knowledge by its valuable publications.

MR. L. L. WOODRUFF (Proc. Soc. Experimental Biology and Medicine, vol. ix., p. 121) has now continued his pedigreed culture of the common ciliate infusorian, *Paramoecium aurelia*, for five years. The culture was started in May, 1907, with a wild individual isolated from a laboratory aquarium. From the progeny of this specimen individuals have been isolated practically daily, and cultivated in sterilised infusions of hay and other vegetable substances. During the five years to May, 1912, 3029 generations have been produced without any conjugation having taken place, and the organisms are still in as normal condition, both morphologically and physiologically, as the original wild ancestor. The author concludes that the original individual cell possessed the potentiality of producing descendants the number of which is represented by at least 2 raised to the 3029th power, and that senescence and the need of fertilisation are not primary attributes of living matter.

IN No. 6 of the Kew Bulletin, Mr. W. J. Bean gives an extremely interesting account of various gardens and parks in South Europe, including the famous garden at La Mortola, the acclimatisation garden at Hyères, the Villa Thuret and Eilen Roc gardens at Cap d'Antibes, and the fine gardens at Milan, Pallanza, Florence, Naples, Bologna, Padua, and various towns on the Adriatic coast. These notes, based on a tour made by the author in early summer of this year, should prove most useful to botanists who may wish to visit Italy and the adjacent parts of South Europe. The same number contains descriptions and plates of two recent additions to the Kew collection—a spurge (*Euphorbia meloformis*) and a cycad (*Cycas Micholitzii*). The former is one of the most remarkable South African spurges, and bears such a striking resemblance to *Echinocactus* that a non-botanist would never suppose that they belonged to two totally different families of plants.

DR. R. R. GATES, who has contributed so much to the recent literature of mutation by his cytological work on Œnothera, describes in *The New Phytologist* (vol. xi., No. 2) a peculiar development which occurred in his cultures of evening primroses obtained originally from the Lancashire coast. In some of the forms the stem internodes remained undeveloped, though growth continued and new cycles of rosette leaves were continually added above while the older ones died away below. In this way a stem was produced which was covered with leaf-bases and bore a crown of leaves at the top, giving a striking resemblance to a cycad. From these and other forms it is hoped by further work to learn something more regarding the manner of origin of the various Œnotheras, and in particular to analyse the De Vriesian factor of evolution and ascertain in how far it is merely a process of hybrid-splitting and in how far it is a more deep-seated germinal disturbance—resulting in part from effects of previous crossing, from the direct influence of changed environment, or from some internal and unknown cause.

MR. NEIL E. STEVENS has sent us a reprint of his recent paper (*Botanical Gazette*, April, 1912) on the cytology of heterostyled plants, containing observations on buckwheat and *Houstonia coerulea*. Zoologists have shown that in various insects the sperms are of two kinds, equal in number, and differing in respect of one or more of their chromosomes, and it has been shown that fertilisation of the eggs by one kind of sperm produces males, by the other kind females. This remarkable discovery has suggested the possibility of a similar condition in other organisms having separate sexes, but so far no evidence of such a "sex determinant" has been obtained in dicœcious plants. In buckwheat, Stevens finds that in the mitosis of the pollen mother-cells the chromosomes of the short-styled form are much larger than in the long-styled form, also that there is a characteristic and constant difference in the arrangement of the chromosomes at one stage (anaphase) of the reducing nuclear division. In *Houstonia coerulea* the difference in size of the chromosomes is less marked, and there is apparently no difference in arrangement.

IN our issue of July 25 we referred to a useful series of wind charts relating to the monsoon area of the North Indian Ocean, published by the U.S. Weather Bureau. This has been supplemented in its meteorological chart of the Indian Ocean for October by an interesting discussion, "Weather of India and her Seas," by the same writer (Mr. W. E. Hurd). He points out the close connection between the meteorology of India and the adjacent seas. Apart from the seasonal effects of insolation, the weather is directly associated with the distribution of atmospheric pressure in various regions, the changes in which produce the summer and winter monsoons. The writer traces the effects of these over various districts in a clear and instructive manner, some of the data being naturally drawn from the records of the Indian Meteorological Department. In the October charts of the North Atlantic and North Pacific oceans the Weather Bureau directs attention to recent alterations in the Act regulating wireless telegraphy, one provision of which enacts that no vessel licensed to carry fifty or more persons shall leave the shores of the United States from October 1 unless equipped with efficient apparatus for radio-communication, to

be used during day and night, and capable of transmitting and receiving messages over a distance of at least one hundred miles.

In "Relative Bestimmungen der Intensität der Schwerkraft" (Karlsruhe: G. Braun), Dr. E. Becker gives the results of a series of pendulum experiments conducted during the years 1900–05 in Alsace-Lorraine. The work of the group of experimenters concerned appears to have been very carefully performed and the reductions of the observations have been carried out with a due recognition of the systematic errors likely to be present. Using Helmert's system of corrections to sea-level and giving to the ideal surface layer of land a density of 2·4, the experimenters find the western Rhine valley to be a region where gravity has its normal value. In general the higher land to the west is a region of gravity-excess. The map which accompanies the work would enable the reader to make a more intelligent use of the tabulated results if by shading or otherwise it gave an idea of the level contours or of the geological distribution. That would at once confirm or disprove the idea left by the table that no marked correlation between gravity-variation and height or geological conditions has been found. Another useful addition to the work would have been some illustrations of the apparatus used and described. It is to be hoped that the experiments will be extended as suggested in the last sentence of the memoir.

The volume of Contributions from the Jefferson Physical Laboratory of Harvard University for the year 1911 extends to nearly 400 pages, and contains eight memoirs, several of which we have already noticed in these columns. More than half the present volume is occupied by the important papers of Bridgeman on the properties of water and of mercury at pressures up to 20,000 kilogrammes per square centimetre, and at temperatures between −80° and +80° C. In addition to the new information these papers supply as to the various modifications of ice and the conditions of equilibrium amongst them, they show that the laws of change of state from solid to liquid are much simpler than the theories and observations of Tammann and of van Laar have led us to believe. Each melting point, for instance, changes with pressure in the same direction at these great pressures as it does at lower pressures, so that there is no maximum melting point in the case of mercury or minimum in the case of water. It seems probable that the maxima observed by Damien were due to slight impurities, too small to have observable effects on the melting points at low pressures, but which appear to have considerable effects at these high pressures.

A copy has been received of the third edition of "The Record of the Royal Society of London," prepared in connection with the celebration of the 250th anniversary of the foundation of the society. The volume, which may be obtained of Mr. Henry Frowde, Amen Corner, E.C., price 15*s*. net, is much larger and more complete than previous editions, and is a valuable official statement of the development and position of our leading society for the promotion of natural knowlege. The chapter of greatest general interest is that with which the volume opens, on the foundation and early history of the society. This has been re-written by the president, Sir Archibald Geikie, who has also supervised and edited the whole work. The three charters are printed in full, with translations, while other chapters are devoted to the statutes, trusts, benefactions, medallists, committees, and like matters. There is a chronological register of fellows, as well as an alphabetical list, with dates of election. The volume is illustrated by twenty excellent plates, mostly from portraits of former fellows in the society's possession. Among the additions to the new edition are portraits of Lord Kelvin, Lord Lister, and Charles Darwin. The officers and the clerical staff have been successful in producing an attractive volume of more than domestic interest.

Mr. C. Baker, 244 High Holborn, has just issued a new classified list of second-hand instruments for sale or hire. The catalogue contains particulars and prices of more than fifteen hundred optical and other instruments and accessories offered at low prices. Every instrument is guaranteed to be in adjustment, having been put in order where necessary in Mr. Baker's workshops or in the works of the original makers.

Fifty volumes of the "Cambridge Manuals of Science and Literature" have now been published by the Cambridge University Press. Among the most recent additions may be mentioned "The Work of Rain and Rivers," by Prof. T. G. Bonney, F.R.S.; "Brewing," by Mr. A. Chaston Chapman; "The Individual in the Animal Kingdom," by Mr. Julian S. Huxley; "House-flies and How they Spread Disease," by Dr. C. G. Hewitt; and "The Psychology of Insanity," by Dr. Bernard Hart. We notice, too, that Mr. L. Doncaster's volume in the series, "Heredity in the Light of Recent Research," has reached a second edition, in which a chapter on heredity and sex has been added.

OUR ASTRONOMICAL COLUMN.

Gale's Comet, 1912*a*.—No. 4602 of the *Astronomische Nachrichten* contains new elements for comet 1912. A set by Mr. H. E. Wood puts the perihelion passage back to October 1·86, and reduces the inclination of the orbit to 51° 54′; another by Mr. Merfield agrees fairly well with that published by Dr. Ebell, who gives a new ephemeris, derived from corrected elements, from which the following is taken:—

Ephemeris, 12h. M.T. Berlin.

1912	α (true) h. m.	δ (true) ° ′	log *r*	log Δ	Mag.
Oct. 13	15 43·4	+ 8 27·1	9·8673	0·0454	6·3
15	15 46·2	+10 28·3			
17	15 48·7	+12 23·9	9·8806	0·0588	6·4

It will be observed that this ephemeris gives the declination for October 13 nearly 1° more northerly than that we gave, from the earlier ephemeris, last week; the calculated magnitude is also considerably fainter. An observation by M. Gonnessiat at Algiers on September 26 gave the magnitude as 8·0.

SUN-SPOT ACTIVITY.—There has recently been some slight suggestion of a recrudescence of sun-spot activity, although one scarcely expects the actual minimum to have passed yet.

In the earlier part of the year very few spots were seen, and those that did appear were very small and seemed to be very shallow, for they generally filled up and disappeared while the region was still on the visible hemisphere. One exception was a fairly large black circular spot, which endured from June 17 to 28, and on Saturday last there appeared a small group, containing two intense nuclei, just south of the sun's centre, on the central meridian; this is now a fair-sized group, and should be seen near the western limb about October 11 or 12.

THE SYSTEMATIC MOTIONS OF SUN-SPOTS.—Acting on a suggestion conveyed to him by the statement that "the rotation periods given by different spots in the same zone of latitude differ more widely than do the mean rotation periods for different zones of latitude," given in Mr. and Mrs. Maunder's paper on the solar rotation period, Prof. Hirayama has analysed the motions of spots given in the Greenwich, Carrington's, and Spörer's publications, and finds that apparently there are two drifts of sun-spots exhibiting distinctive systematic motions. The angular velocity of drift i. is represented by $\xi = 14{\cdot}37^\circ - 2{\cdot}97^\circ \sin^2\lambda$ (where λ = the heliographic latitude), and of drift ii. by $\xi = 14{\cdot}69^\circ - 2{\cdot}65^\circ \sin^2\lambda$; the former agrees fairly well with the mean values found by other investigators, while the latter exceeds it, showing a mean rate about 0·35° greater than that indicated by drift i. For the lower latitudes, the rotation period proper to drift ii. agrees fairly well with that found spectroscopically by Messrs. Storey and Wilson, and Prof. Hirayama suggests that possibly certain groups of spots, by a proper motion of their own, come to the same level as the chromospheric layer investigated spectroscopically, and attain its angular velocity. He also suggests that this idea of two drifts may explain the distribution of sun-spots with different rotation periods in any particular zone of latitude. The data considered by him show that there are about twice as many sun-spots collected in drift i. as in drift ii. (Journal of the College of Science, Imperial University, Tokio, vol. xxxii., No. 7.)

THE PARALLAX OF NOVA LACERTÆ.—In No. 52 of the *Mitteilungen der Nikolai-Hauptsternwarte zu Pulkowo*, Herr Balanowsky discusses the attempt made at Pulkowa to determine the parallax and proper motion of Nova Lacertæ. Sixteen plates were taken between January 4, 1911, and February 19, 1912, but two had to be rejected because the images were poor. The first solution from the remaining fourteen plates gave values which were small as compared with their probable errors, but indicated that the proper motion in declination was probably zero. The final solution gave for the value of the parallax $0{\cdot}005'' \pm 0{\cdot}020''$, which practically means that it was zero, and indicated that the proper motion in right-ascension did not exceed $+0{\cdot}015$.

THE ROYAL HUNGARIAN ASTROPHYSICAL OBSERVATORY.—In No. 14 of the *Kleinere Veröffentlichungen des Königl. Ungarischen Astrophysikalischen Observatoriums*, Dr. Konkoly gives a very detailed description of the instruments added to the equipment of the observatory between the beginning of 1908 and the end of 1911. Many of the instruments have been made for special purposes, and the book, consisting of 166 pages, fully illustrated, should prove exceedingly useful to anyone desiring to set up instruments for astrophysical researches.

OBSERVATIONS OF VARIABLE STARS.—In No. 9 (vol. i., second series) of the *Memorie della Società degli Spettroscopisti Italiana*, Signor E. Padova publishes the values and light curves determined from observations of variable stars during the years 1907–11. Eleven stars are dealt with, and these are divided into three groups, viz. Algol variables, short-period, and long-period variables. In several cases the light-curves are compared, graphically, with those drawn from published elements, or determined by other observers, and the differences between them are discussed. For Mira Ceti the observer found a minimum of magnitude 9·36 on January 15, 1912.

BIRD NOTES.

IN the August *Zoologist* Mr. Collingwood Ingram points out that four races of the furze-warbler are recognisable, namely, the typical *Sylvia undulata* of the northern Mediterranean countries, *S. u. aremoricus* of the Atlantic coast of France and Spain, the north African *S. u. toni*, and the British *S. u. dartfordiensis*, a Dartford warbler, the last being distinguished by its brown back and the smaller development of the white tips to the throat and breast feathers.

The migratory birds visiting the Buffalo River district form the subject of an article by the Rev. R. Godfrey in the June issue of the Journal of the South African Ornithologists' Union. Among the species observed were the white and black stork, the European swallow, and several kinds of cuckoos.

In the July issue of *The Emu* Dr. J. B. Cleland continues his account of the results of an examination of the contents of the crops and stomachs of Australian birds, the total number of species which have passed through his hands being 305. Farmers and gardeners should now be able to discriminate without difficulty between beneficial and harmful birds.

A hand-list of the birds of Formosa, by Mr. S. Uchida, is included in vol. iii. part i., of *Annotationes Zoologicae Japonenses*. In a list published in 1907 by Messrs. Ogilvie-Grant and La Touche, 260 Formosan species were recognised; the author has been able to raise the number to 290. The discovery of a species of Dicœum has introduced an additional family into the avifauna of the island. We notice that on page 169 *Cuculus canorus* is misprinted *Cuculus canolus*, the error being repeated on page 209 of the distributional list.

No. 23 of *Harmsworth Popular Science* contains an article on the difficulties of bird-classification, although its contents scarcely bear out the title. There are, moreover, statements which do not represent the facts, as, for instance, the assertion that the seriema was originally grouped with the secretary-bird. Again, we find it stated on page 2736 that "the boat-billed heron, . . . the whale-headed stork, . . . and the hammer-head are famous members of the heron tribe," whereas these three birds severally represent the same number of distinct families, which in the British Museum Hand-list are assigned to as many suborders.

In *British Birds* for September, Mr. H. W. Robinson states that two nests of the eider were observed on June 2, 1912, on a small island just off the coast of Ireland. Hitherto eiders have been known in Ireland only as occasional stragglers. It is a matter for regret that in each instance the eggs were taken.

In Reichenow's *Ornithologische Monatsberichte* for July and August, 1912, Mr. J. Thienemann records that a laughing gull (*Larus ridibundus*), marked at Rositten, was shot on a swamp in the West Indies in November, 1911. R. L.

EXPERIMENTAL WORK AT AN AGRICULTURAL COLLEGE.[1]

THE bulky annual before us consists of reports from the various departments of the South-Eastern Agricultural College, prefaced by editorial notes, which summarise the present position of the college. This appears to be satisfactory, and progress in several directions is being made. The editor is dissatisfied with the recognition of Long Ashton by the Development Commissioners as the chief fruit research station for England and Wales. But it must not be forgotten that Long Ashton serves the most important fruit area in the country, extending from Devonshire to Herefordshire and Worcestershire. Wye, however, is to have a research plantation for fruit and hops.

(1) *Farm and Dairying.*—The chief point of interest mentioned by Mr. Mackintosh has reference to the good results obtained by spraying potatoes: "the yields from sprayed and unsprayed plots showing a balance of four tons per acre in favour of the former." The sugar-beet experiments proved, as elsewhere, that the crop can be successfully grown in this country, but it remains to be shown whether the manufacture of beet-sugar is destined to become an important British industry. Sugar-beet slices and coconut cake were found to be useful artificials.

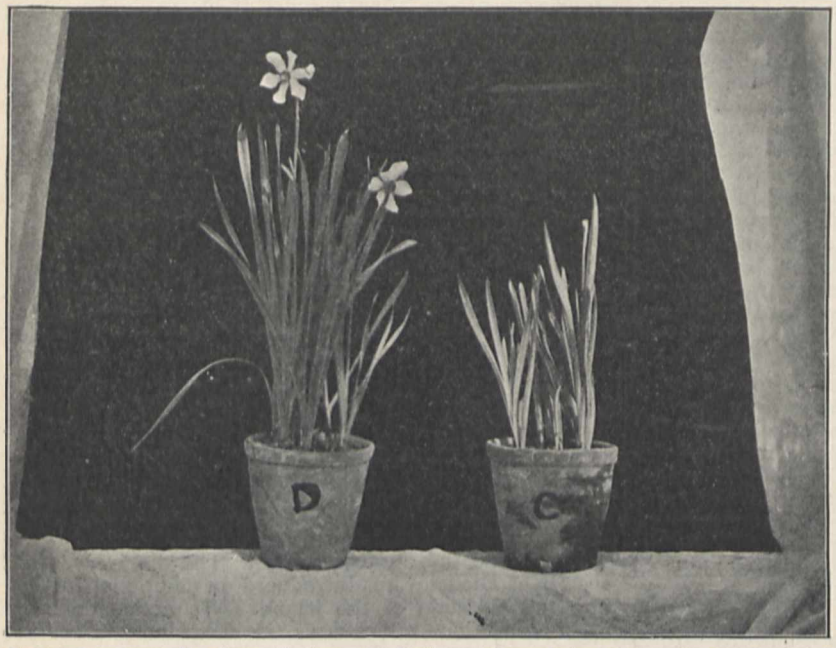


FIG. 1.—Narcissus. D—"Dipped" plants. C—Undipped or control plants. From the Journal of the South-Eastern Agricultural College.

(2) *Hops and Horticulture.*—The article by Messrs. Smith and Wellington on the packing of apples is particularly interesting, especially in relation to the establishment of a commercial fruit show in Kent.

(3) *Economic Zoology.*—Prof. Theobald's report is of considerable length, and, as usual, contains a large amount of familiar matter as well as valuable additions to knowledge. The illustrative plates are excellent. The author has spent much time in investigating aphides, of which 174 species (ten hitherto undescribed) have been found in Kent. The egg-laying of the pear-midge (*Diplosis pyrivora*, Riley) is for the first time described in detail; an excellent account is given of the narcissus-flies (*Merodon equestris*, Fbr., and *Eumerus strigatus*, Fln.); and the house-fly as a carrier of disease germs is described in unsavoury detail.

(4) *Chemistry.*—The two most important articles in Prof. Auld's report have reference to the formation of prussic acid from linseed cake and other feeding stuffs, indicating a certain necessity for care in their use; and the extraction of nicotine from tobacco, with a description of experiments in denaturing.

(5) *Botany.*—Prof. Parkinson contributes an interesting note, in continuation of previous work, on the forcing of plants by warm-bath treatment, *e.g.* bulbs of hyacinth and narcissus soaked in water at a temperature of 88° F. for twelve hours rapidly outstripped untreated ones (Fig. 1). Mr. Garrad gives his second report on the growing of tobacco for nicotine extraction, and the Principal contributes a note on the smoking qualities of the tobacco, which would seem to be remarkably good.

(6) *Economic Mycology.*—Prof. Salmon's invaluable report deals with the use of lime-sulphur wash and with American gooseberry mildew; and a reprint is given of the important presidential address on "Economic Mycology and some of its Problems" which he delivered to the British Mycological Society last year. Among other things, the significance of "bridging species" is pointed out, *e.g.* the spores of grass-mildew (*Erysiphe graminis*) taken directly from *Bromus racemosus* cannot infect *B. commutatus*. They can, however, infect *B. hordeaceus*, and the spores developed in this species germinate effectively on *B. commutatus*. The methods of combating fungoid disease are also discussed in a luminous fashion.

(7) *Notes on Hops.*—Prof. Salmon describes in detail the work done by way of raising new varieties of hops, and the sending out of male hops to growers.

(8) *Veterinary Science.*—Prof. Cave decides against preventive treatment, on the lines so far devised, in the case of "struck sheep," and gives an account of Jöhne's disease; while Mr. Bruce Gardener communicates the results of his useful research on parasitic gastritis in sheep and cattle ("Lincolnshire lamb disease"), due to species of the nematode genera Hæmonchus, Ostertagia, and Trichostrongylus. As these pests are common to sheep and horned stock, it is clear that the common practice of turning cattle on to pasture dangerous for sheep should not be pursued, though horses and pigs will take no harm.

J. R. AINSWORTH-DAVIS.

[1] The Journal of the South Eastern Agricultural College, Wye, Kent, No. 20 for 1911. Pp. 519. (London and Ashford: Headley Bros.) Price 7*s.* 6*d.*, post free.

ADDITIONAL FORTHCOMING BOOKS OF SCIENCE.

AGRICULTURE.

Williams and Norgate.—Soil Fertility and Fertilisers, J. E. Halligan, illustrated.

ANTHROPOLOGY.

Chapman and Hall, Ltd.—The Aborigines of South America, Col. G. E. Church. *G. G. Harrap and Co.*—Cave, Mound, and Lake Dwellers, and other Primi-

tive People, F. Holbrook, illustrated. *Hodder and Stoughton.*—The Individual Family of the Australian Aborigines, B. Malinovski. *Williams and Norgate.*—The Lost Language of Symbolism: an Inquiry into the Origin of Certain Letters, Words, Names, Fairy Tales, Folklore, and Mythologies, H. Bayley, 2 vols.

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THE BRITISH ASSOCIATION AT DUNDEE.

SECTION K.

BOTANY.

OPENING ADDRESS BY PROF. FREDERICK KEEBLE, SC.D., PRESIDENT OF THE SECTION.

IT is with more than the normal trepidation natural to presidents that I, who have worked on the borderlines of several biological sciences, undertake the task of addressing the members of this section. As well might a rogue and snapper-up of unconsidered trifles recite his doggerel songs before a bench of learned magistrates.

Therefore, although I have studied from their works the ways of presidents, and although I shall strive to keep the path which they have mostly trod, yet should I stray I plead with Autolycus that—

> "When I wander here and there,
> I then do most go right."

The addresses which I have consulted show me two alternative models.

I may take all knowledge for my province and discourse on the progress of our science as a whole. This is Ercles's vein, a tyrant's vein. Or as a lover of a department of the science and more condoling, I may confine my address to a special branch of botany. Each method has its merits and its drawbacks, and the one is corrective of the other.

The departmental method depicts the tree of knowledge in sympodial symmetry. The branch which the president of one year holds out for our inspection is seen arising from an erstwhile dormant lateral bud far back from the growing point of the branch exhibited by his predecessor. Under the magic of the presidential hands the new branch grows as grows the enchanted mango. Like the lean kine, it eats up the fat kine, and by the end of the address it dominates all other branches.

The general method shows the tree in other guise. As an artist is wont to paint a tree, so the historian draws it on monopodial lines, with branches standing in due subservience to the leader and in strict co-ordination with one another. Together these methods tell the truth, which is that the tree of knowledge grows, like many another broad-leaved tree, by a mixed process of monopodial sequences following upon sympodial developments.

What is to the specialist, and indeed for a space is, the luxuriant predominance of his branch appears in historical perspective but as a new lateral for the extension of all the sublateral shoots of science.

Such a new basis for the further growth of all the branches of botany is provided by the lusty shoot of Mendelism, and after weighing the alternatives, and with the reserves announced already, I propose to try to show that this recent outgrowth of the tree of knowledge is destined not to mar its symmetry, but to aid the growth of the whole crown. This, my chief task, should have been my first care had not an event occurred since the last meeting of this Association which compels me, in common with all botanists, to divert thought from its preoccupation and to look back along the route which our science has travelled during the last few decades.

That event, I need not say, is the death of Sir Joseph Hooker, a former president of this Association and twice president of this section. The most venerable and distinguished of British botanists, Sir Joseph Hooker was well-nigh the last survivor of that band of Victorian naturalists who helped to lay the foundations of biology and to disseminate broadcast the knowledge which they made. The story of the labours of that group of naturalists—Lyell, Darwin, the Hookers, Wallace, Huxley, Galton, and others scarcely less distinguished—has been told so often that there is no need to re-tell it now. Nor need I recount the work of Hooker. His discoveries are known and require no re-enumeration. They are incorporated with the common fund of knowledge. British botanists will determine, doubtless, to consecrate a special occasion to the commemoration of Hooker's services to science and to the perpetuation of his memory. My duty it is to express, on behalf of native botanists and of our guests who honour us with their presence, our sense of loss in the death of Sir Joseph Hooker and our admiring recognition of his achievements.

And with the example of that long life devoted until its latest hour to the pursuit of science, I would fain address myself forthwith to my special task; but despite my will I find my thoughts enchained in the contemplation of the life and times of Hooker. Systematist, explorer, critic, writer, administrator, Sir Joseph was first and last a botanist. The versatile Hooker was a specialist.

Thus I find myself turned again to the thoughts which vexed my mind at the outset of this address, urged now to ask outright whether the specialisation of our times has the quality which distinguished that of Hooker and his contemporaries.

This is the uneasy phantom that has been haunting me and luring me to the ramparts when I should be wooing my chosen theme. It haunts me, refusing to be laid. Reason fails to exorcise that ghost. Its uneasy presence lingers near me even though I conjure it with specious argument; urging that these days are days of specialisation *à outrance*: that nowadays both in the art and practice part of life we live by the intensive cultivation of small-holdings: that the fields of science are parcelled out in small allotments. Were I—a simple officer—the sole subject of this visitation I should attribute it to fantasy, and with Horatio cry "Tush!" but beside this poor Bernardo, Marcellus, officer and scholar, has likewise seen it "in the same figure like the King that's dead," and who may refuse to entertain a ghost presenting this—the highest of credentials?

Therefore I offer it again my arguments, insisting that at least among our elders we have specialists as versatile as any of the Victorians. The ghost is not impressed. Instead, it rises to a fuller height, and lays its incorporeal finger on the row of volumes which line the shelves above my head. My obsequious eye follows the direction, and beholds Lyell's "Principles," Darwin's "Voyage," Hooker's "Journal," Huxley's "Essays," Wallace's "Island Life," Galton's "Natural Inheritance," and the other classics from his clients' pens. With the dawn of my comprehension the spectre vanishes, and I am alone, but not in peace. The message left with me appears to translate as follows: The present generation has become expert in intensive cultivation of scientific knowledge, but it has forgotten how to market its produce. In the preoccupation of specialisation it neglects the art of expression. It sinks the artist in the artisan. Each specialist exchanges "separates"—hateful term—with other specialists, but few among us are on speaking terms with the cultured general public curious to know what science is achieving.

The translation into common English of our scientific works is done, like that of foreign classics, too much by hacks and amateurs, and too little by skilled hands. The present generation lets its modesty wrong it; for the science of our day is no less full—nay, many times more full—of interest and wonder than that of fifty years ago.

Still worse: to fail to cultivate the art of expression is to blunt the power of thinking, for the adage "clear thinking means clear writing" stands though the subject and object be transposed.

Such is the nature of the charge which my visitant left with me; and though, as it must have known, my rough translation fails to convey the sober grace of the original, I think that I shall not be alone in pleading guilty to that charge.

Nor perhaps will my fellow-specialists resent an attempt to trace the origin of our lack of literary grace. This defect is in part inevitable and in part remediable. Inevitable because of the increasingly engrossing nature of scientific investigation, because of the relatively small natural gift of expression which nature has vouchsafed to the English race, and because, as science becomes more complex, its followers think more and more in symbols, and those who think in symbols are apt to write in shorthand. The defect is remediable because it is traceable in some measure to the training to which we submit our youth. That training neglects too much the literary side of education.

As it seems to me, there is a fundamental error in our mode of training men of science. The error consists in this: that students who come to English universities are treated in intellectual matters not as youths but as men of mature minds. The professorial potter takes the clay as he finds it, and, no matter what its state, fires it forthwith, and lo! in course of time it is converted into earthenware. Were the assumption on which he acts well-founded, the method might be justified. If our undergraduates were, as we assume they are, well found in general culture, trained already in scientific method, familiar with the language of our fathers, and apt also to read and speak and write some other tongue, then let us take them straightway and bake them in the oven of specialisation.

But I at all events have never met those students, and, outside the ranks of genius—which training toucheth not—I believe they do not exist. The error, as I conceive it, lies in our failure to apply, in drafting schemes of training, the biological law that as society grows older its young men grow younger. Undergraduates call themselves men, not solely from a sense of pride, but also in obedience to tradition. Centuries ago they went up to the university as men of fifteen or sixteen; now they go up as youths of eighteen or nineteen. With respect to moral discipline we are not unforgetful of their youth, but with respect to intellectual education we treat them as though they were grown up. Even the saving second subject has, I am told, been discarded from the final honours

course. Let me give an example in illustration of our methods. It is found that a student in his second or third year knows no German, and we advise him to learn it. But in what a way, with our tacit approval, does he set about the task! So that he may tear the meaning from a scientific text as John Ridd clutched the arm of Carver Doone and tore the muscle out of it as the string comes out of an orange!

This barbarism we permit, because we know that it is no barbarism but expediency for a trained workman to take up any tool he needs and to use it as he wills. In the elegant language of modern literature, "and what he thought he'd most require he went and took the same as we."

Yet, unless we hold that mental training is a scholastic fiction, and that the teacher's sole business is to supply carefully selected and copious provender for the stuffing of students like Surrey fowls, it must be our care to encourage general as well as special culture in our students.

A further criticism which I have to make upon our university methods will seem to some far-fetched. We are prone to forget that the twin gifts of youth are enthusiasm and idleness. The former we encourage, but the latter, falling within the category of morals, we visit with our displeasure. There is, however, an idleness which is not laziness, but a resting period of the organism tired with the trouble of growing up. I could wish that our English universities understood intellectual liberty as well as German universities understand it. We are apt to mind our sheep too much, and to overrate the virtue of docility.

I would plead for more breadth and less special knowledge, for more licensed freedom, a lesser uniformity, a wider search for gifts, and a slighter regard for specialist attainments. It is never too late for a well-trained mind to master a new subject, but he who neglects the substance of education for the shadow of mere knowledge robs himself of half the pleasure of his work and of every chance of greatness.

In attempting thus to diagnose a complaint which some may think is non-existent, I have laid myself open to attack at every point; yet I have a flickering hope that I may be dealt with after the manner prayed for by an examinee whose paper, which I read, contained the appeal: "Mr. Examiner, please temper justice with mercy, for I am so young in mind." This hope I base upon the facts that modern science has at least taught tolerance, and that I have ever found my botanist colleagues conspicuous for this virtue. They understand that even the most minor among prophets prefers the stake to silence, and their good humour acquiesces in the interchange of rôles whereby the martyrdom which should be his is borne by them in listening to his wrathful words.

Anticipation of toleration so undeserved leads me to regret almost that I ever introduced that ghost at all. For now that it has served my purpose I am free to admit that I might have laid it long ago by other and *tu-quoque* arts.

I, too, might have pointed to those shelves, and at the sight of Mendel's work it would have vanished with a blush. For with all their gracious gifts the Victorians whose just praises I have sung failed to discover that Mendel was alive among them, and showing a way to solve the problems over which they themselves were puzzling.

The merit of the discovery of the greatness of Mendel's work belongs to our generation, and those of us who had no share in it have at least the right to applaud the discoverers and to score the discovery to our side.

So I may conclude the contrast of Victorian with modern naturalists with the reflection: theirs, the higher meed of culture; ours, perhaps, the greater perspicacity.

If, as I am prepared to maintain, the greatest gift which an experimental science may receive is that of a new, serviceable, general method, then to no man are biologists more indebted than to Mendel, for such a method he gave to our science. If, further, this claim can be established, I am absolved from the task of answering the critics of Mendelian doctrine.

Who does not recollect the answer which John Hunter gave to someone—Jenner, perhaps—who wrote to that great experimenter expressing doubt of the validity of an hypothesis? "Don't think—try," was Hunter's fine response.

If it were my purpose to discourse on Mendelian doctrine, it would be my duty to carry on that work—like the early builders of that doctrine—with sword in one hand and trowel in the other, and to try in emulation of the pioneers to take an equal joy in using either implement. But my work concerns the method and facts accomplished by its use, and, as I understand philosophy, the writ of criticism does not run in the domain of accomplished fact. A homely illustration will serve to define my attitude. Here is a new knife, and there an old loaf, the crust of which has turned the edge of other implements. If with this knife I cut that loaf, it is idle to tell me that my knife is blunt. One form of criticism, and one only, is valid in such circumstances, and that is the constructive criticism of offering a better instrument. If I want bread, and Mendel's knife can give it to me, I shall go on cutting, indifferent to the stones of destructive criticism.

My business, therefore, is to meet criticism, not by dialectics, but by confronting it with the facts accomplished by this method and by showing that its use opens new pathways on the borders of the unknown.

Now, if we scrutinise the method of Mendelian research, we may see that there can be no criticism of it.

Give a chemist a complex mixture of many compounds to describe: how does he proceed? The chemist sorts out the ingredients, and submits them severally to analysis. Such, also, is the method of the Mendelian analyst. Give him that complex mixture which is called an individual, and he sorts out the ingredients and submits them to analysis. Ask him how two complex mixtures behave when they are bred together, and he re-defines the question in such terms that it ceases to be enigmatical, and becomes susceptible of solution by experiment.

I am not concerned to claim for the Mendelian method the exclusive possession of these virtues. All I claim is that for the work of making a physiological analysis of individuals, and of thereby establishing a physiological classification of plants and animals, the Mendelian method has proved its value. It effects the service by a simultaneous analysis of germ and soma.

Let it be conceded at the outset that this analysis is made, not by direct but by indirect methods. For so long as the physical nature of living substance remains unknown we can scarcely hope to resolve an individual into its physical components. All that can be done is to make comparative analyses of individuals and to discover how their several components differ from one another.

For our present purpose we may represent the individual by an equation:—Individual $= x + c$; where c represents the sum of a long series of characters of the individual and x an imaginary or real groundwork left after all the Mendelian characters—the sum of which is c—have been removed by analysis from the individual. The Mendelian method is con-

cerned directly with the resolution of *c* into its components. Indirectly it is concerned also with *x*; for by the pursuit of the method the full value of *c* may be determined, and hence that of *x* may be inferred. This concession made, it is permissible to concentrate our attention on the term *c*.

Thus the business of the Mendelian is to resolve the complex of characters which is possessed by an individual into its constituent unit characters. As a consequence of this experimental analysis Mendelism is enabled to restate the problem of the behaviour in inheritance of two individuals in these terms:—

The complex of characteristics which distinguishes an individual is the expression of the sum of a long series of characters. As the individual arises from germ cells so each character arises from a germ within the germ cells. Such germs of characters are called factors. When two germ cells unite to form an incipient individual or zygote they bring together the similar factors of a given character—one factor from the one germ cell and the other from the other. As the zygote forms the mature individual, so the paired factors give rise to a character of the individual.

The body characters are the flowers of the factorial seeds implanted in the germ cells.

Some characters are simple and derive from one pair of factors only; others are of an ascending order of complexity and may be traced to the co-operative agency of two, or more than two, pairs of factors. In the case of a complex character the determining factors may be unlike one another or they may be alike. Thus two pairs of different factors are required to produce the character of colour in certain flowers; on the other hand, it is at least probable that certain characters are the outcome of repeated doses of the same factorial stimulant. Further, the individual is a dual thing—a double-barrelled gun. Each barrel is loaded with the factorial charge supplied by one of the two gametes by the union of which its duality is constituted. Conversely and consequently a gamete or germ cell is, in comparison with the individual, of single and not of dual nature. It has one barrel only, and therefore can carry or give effect to one, and only one, of the two factorial charges with which the individual was supplied at the time of its formation.

Our image of the double-barrelled gun serves also to illustrate the several states in which an individual may find itself with respect to its charge of factors of any given simple body character.

Both barrels of the gun may be loaded. An individual in like state possesses two factorial charges and produces gametes, all of which are alike in the possession of one of these factors. Therefore, such an individual, when self-fertilised, or mated with its like, produces gametes which are all alike in this respect, and these gametes, fusing in pairs, give rise to individuals which all possess the character in question. Such individuals are homozygous, they breed true to the character.

Neither barrel may be loaded; and an individual in like state is also homozygous. It breeds true to the absence of the character. If a gamete of the former individual meet with one from the latter individual, the resulting zygote is in like case with that of a double-barrelled gun of which one chamber only is loaded. The zygote is heterozygous for the character. Unlike the homozygotes, which breed true, the heterozygous individual does not breed true to the character in question.

By the application of the foregoing propositions and a little arithmetic, it may be predicted that the offspring of the heterozygote fall into three groups—one homozygous for the character, and another heterozygous, and a third homozygous for the absence of the character—and that, further, these types of individuals occur in the proportion of 1 : 2 : 1. Needless to say, the prediction is susceptible of verification by experimental breeding from the heterozygote. These are Mendelian commonplaces with which I should have hesitated to occupy our time were it not for the fact that I desire to emphasise the epoch-making nature of Mendel's method. The magic wrought by genius is potent because it is simple. The rules of Mendelian method are simple. If it be urged that I have broken my promise and strayed from method to doctrine I would ask which of the simple propositions I have stated may be demurred to by any student of biology?

The supreme importance of Mendel's contribution to science consists in this: that instead of mixing anything with anything "in the gruel thick and slab" of a witches' cauldron, he has taught us to cast the horoscope of Fate by the method of genetical analysis of individual characters. Thus the first part of the Mendelian restatement of the old problem of heredity reads: Investigate one by one the modes of inheritance of the several characters of an individual. Choose for this purpose organisms which are as far as possible alike in all respects except for the character under investigation. Carry the experiment to its conclusion, even to the third or fourth generation. If uncertain results are obtained, ascertain before discarding the method whether the uncertainty may not be due to the interference of other characters not to be suspected *a priori* of exercising an influence upon the expression of the character under investigation.

Who, for example, would suspect a morphological character like thickness of stem of exercising an influence on the time of flowering of a plant? Yet such is the case with the pea (*Pisum sativum*), and there is evidence that when this disturbing influence is removed inheritance of time of flowering follows Mendelian rules.

The second part of the restatement of the problem of genetics may be expressed as follows: Only by the use of individuals of proved constitution with respect to a given character may the effect of external conditions on organisms be determined. The study of variation must be preceded by Mendelian analysis and synthesis. Let me illustrate this theme by an example.

The species, *Primula sinensis*, the Chinese primrose, has given rise to many distinct varieties. Among these varieties are some with white flowers and others with magenta, blue, red, or other coloured flowers. Each of these varieties may be obtained of florists in a pure strain—that is to say, in a strain which breeds true to flower-character. For our immediate purpose we will group these varieties into white and coloured forms.

It has been shown, however, that this apparently natural mode of grouping is inadequate to give a correct idea of the genetic constitutions of these races. It would seem self-evident that the white races differ from the coloured races by the lack of flower-pigment; yet Mendelian analysis demonstrates that there are more subtle differences between the different races. These differences become apparent when true-breeding white and coloured plants are crossed with one another; for it is then discovered that two types of white-flowered plants exist, and it is only by their fruits—their offspring—that ye may know them. Thus if certain white-flowered races are chosen for the experiment, the result of crossing white and colour is a coloured F_1 generation. If certain other white races are used and mated with the coloured form the offspring of the cross all bear white flowers. The

different genetical behaviours of these heterozygous first generations give the clue to the difference between the two forms of white used as parents. In the former case—that in which the first (F_1) generation consists of coloured offspring—the second (F_2) generation, raised by self-fertilising F_1 individuals or by crossing them with one another, consists of coloured : white in the proportion of 3 : 1.

Whence we conclude that the white used in this experiment owes its character of whiteness to lack of the pigment-producing factor which is present in the coloured parent race. This conclusion is confirmed by the genetical behaviour of the whites of the F_2 generation. Such extracted whites breed true to flower-character—that is, give rise to white-flowered offspring only. White-flowered races which behave in this manner are termed recessive whites.

In the second case—that in which the F_1 generation consists of white-flowered offspring—the F_2 generation, from selfed or intercrossed F_1 plants, consists of three white : one coloured. The coloured offspring breed true. Of the three whites one breeds true to whiteness and the other two give rise, like the white F_1 generation, to three white : one colour. White races which thus impose their whiteness on the offspring of their union with a coloured race are known as dominant whites. Mendelians account for the genetical behaviour of dominant whites by assuming that they carry the character for colour and also a character for colour-inhibition. This hypothesis, which is novel to biology, is amply justified by genetical results. It propounds a series of questions to the physiologist and biochemist, and in so doing exemplifies the fruitfulness of Mendelism. We shall see immediately whether the biochemist is able to take up this Mendelian challenge and what answer he can give to it.

At present, however, we are concerned to show by an example the necessity of prefacing the study of variation by Mendelian analysis. It was stated just now that the cross, dominant white by colour, results in a white F_1. That statement requires amplification. Grown under normal conditions the F_1 individuals bear pure white flowers; but if grown in somewhat higher temperatures the flowers develop a distinct though pale flush of colour. It is easy to show that the factor for colour is unaffected by the changed conditions, for the flushed F_1 individuals yield offspring of the same kind and in the same proportions as those produced by white F_1 plants.

It is fairly evident that the flushing is produced by the destructive action of heat on the inhibitor. In pre-Mendelian times this response to temperature would have been added without more ado as yet another ornament to dress the window of that old curiosity shop which is stocked with miscellaneous and heterogeneous articles all ticketed with the label "variation."

But in the light of Mendelism we may see in this effect of temperature the result of the casting-vote of circumstance on a heterozygous constitution. We may recall instances—as, for example, those provided by the well-known experiments on the effects of high temperatures on insect larvæ—which seem to show that environmental agencies may single out not only characters but also factors for attack. Thus we may begin to cohere in series the hitherto sundered and scattered phenomena of variation.

It is not yet possible to say how much of variation is to be put down to the interplay of characters, or, rather, to the differential effects of external conditions on characters which tend to balance one another; but this at least may be said—that the old and worn controversy on acquired characters was so much waste of words, because the problem purporting to be discussed had never been defined. Like the half of human quarrels, it was a quarrel about words.

It is stated in the books that the formation of peloric (regular) flowers may be induced by uniform illumination. Was the material used in the research homozygous or heterozygous? Does uniform illumination just prevent the unpaired factor from inducing normal growth? If so, what is the effect on the homozygous normal? These are examples of questions which suggest themselves at every turn, and they will abide the answer of experiment. The time is approaching when it will be possible to test the validity of the hypothesis on which the superhypothesis of natural selection rests apparently secure from verification or disproof.

That hypothesis maintains that everything is in a state of flux; that variation occurs at all times and affects all parts. This may be true of multiple mongrels; of organisms which are heterozygous for many characters. On the other hand, nothing is more surprising than the stability of forms which are pure-bred for a fair number of characters, and it is at all events a suggestion not to be rejected summarily that plants pure bred for a considerable number of characters may exhibit a constancy and stability not usually associated with our ideas of living things.

In any case, it is open to the biologist to provide himself with suitable material wherewith to study the range and scope of variation and to investigate the conditions under which the organism discards old characters and regresses or acquires new ones and progresses. It is open to the Mendelian breeder to standardise creation.

Thus in fulfilling the first part of its task—that of defining the pure-bred—the Mendelian method has provided the material for the fulfilment of the second part—namely, the investigation of the conditions which make for the stability and instability of the organism. I think the time has come when this latter task might be undertaken on a large scale and with good prospects of success.

So far I have played the part of one of those street-corner watchers of the skies who offer a telescope for the inspection of the heavens. I have now to take a turn myself, and by means of the binoculars of Mendelism and physiology survey, not the celestial bodies, but certain new features of a small and narrow terrestrial field which this instrument brings within our ken. My survey has reference to the phenomena of the pigmentation of plants, and is confined to those presented by the anthocyan or sap pigments to which the colours of many flowers are due.

Until recently knowledge of the processes of pigmentation advanced along two main and independent lines. One line of advance—that followed with such brilliant success by Bateson and the Cambridge school, as well as by other students of genetics—has led to a wealth of exact knowledge with respect to the factors and characters which determine coloration. The other line of advance, pursued with no less brilliant results by Chodat and Bach and by Palladin and his associates, has resulted in a great increase of our understanding of the biochemistry of pigmentation.

The merit of being the first to combine the genetical with the biochemical method belongs to Miss Wheldale, to whom, moreover, we owe a good working hypothesis of the nature of the processes involved in pigment-formation. The work of Palladin and of Chodat and Bach is so well known that I need not review it in any detail. To Palladin we owe in large measure the conception that respiration consists in a sequence of enzyme-like actions, the later of which result in oxidations and are ascribed to oxydases. To the same observer we owe also the suggestion

that chromogens play a part in the oxidations set up by oxydases, and that these colourless chromogens may undergo either alternate oxidation and reduction and so take a continuous part in oxydase action, or undergo permanent oxidation and so constitute the pigments of the plant.

Chodat and Bach have given us a serviceable conception of the nature of oxydases. According to the Chodat-Bach hypothesis, oxydases are of dual nature; the complete oxydase consisting of two parts—a peroxydase and an organic peroxide. An oxydase reacts with oxidisable reagents, such as guaiacum, to produce a characteristically coloured product. Hence these reagents may be termed oxydase-reagents. Peroxydases react with oxydase reagents only if there be added, as a substitute for the organic peroxide of the complete oxydase, a source of active oxygen in the form of hydrogen peroxide. Both oxydases and peroxydases occur in the cells of plants, and may be identified in extracts therefrom.

The work of Görtner on the pigments of insects adds confirmation to the view that pigments are the product of the action of oxydase on chromogens. Thus he has shown that the black or brown melanin of the integuments of insects is produced by the action of an oxydase, tyrosinase, on some such product of protein-hydrolysis as tyrosin.

Miss Wheldale's studies have led her to formulate the hypothesis that the anthocyan pigments of plants are the outcome of a series of chemical changes of the following order: Glucosides hydrolysed by emulsin yield chromogens which, acted on by oxydases, give rise to anthocyan pigments. The difficulty in the way of further advance lay in the unsatisfactory nature of the methods for identifying oxydases derived from plant tissues. Hence when we turned our attention to this subject Dr. E. F. Armstrong and I made it our first task to search for means whereby we should be able not only to identify, but also to locate, oxydases and peroxydases in plant-tissues. Clarke had tested already numerous oxydase-reagents and found that certain among them are adapted for microchemical use. As the result of a considerable number of trials of known reagents we have found that α-naphthol and benzidine are each adapted admirably for the purpose of locating oxydases. By means of these reagents we have been able to map out the distribution of oxydase and peroxydase in the flowers and other parts of various plants, and although the work is laborious and the technique as yet imperfect, the results afford strong confirmation of the current hypothesis of the mode of formation of anthocyan pigments. This confirmation, however, was rendered possible only by reason of the fact that we worked with races of plants bred on Mendelian lines, and hence of known genetic constitutions.

Our method of investigation is briefly as follows. The oxydase-reagent is used in weak alcoholic solution, the part of the plant to be tested is incubated in the solution for a suitable time, and if no oxydase action takes place—that is, if no characteristic coloration of the tissues occurs—the material is tested for peroxydase by the addition of hydrogen peroxide. The method may be employed for intact corollas or petals or for sections of plant-tissues.

It is important to mention that the first result of immersing a sap-pigmented tissue in either reagent is the decolorisation of the tissue. For example, a corolla of a coloured-flowered race of *Primula sinensis* loses its colour completely after being immersed for an hour or two in either reagent. The decolorised corolla, which in the case of *P. sinensis* remains colourless, is treated with hydrogen peroxide, with the result that a well-marked peroxydase reaction is obtained. The reaction is confined to the non-chlorophyllous parts of the corolla, and does not occur, except in the epidermal hairs, in the region of the yellow or green eye, the tissues of which contain chlorophyll. Indeed, there is good reason to believe that chlorophyll inhibits oxydase action.

By treating similar flowers with each of our two reagents we find that the action of α-naphthol and benzidine are, in a considerable measure, supplementary one of the other. Thus the lilac-blue α-naphthol reaction is confined, or almost confined, to the veins of the corolla, the brown benzidine reaction is exhibited by the superficial (epidermal) cells and also by the veins. In order to emphasise the facts of distribution we speak of the peroxydases of *P. sinensis* as epidermal peroxydase and bundle oxydase. The former occurs in the epidermis and in the epidermal hairs, the latter in the bundle sheath which accompanies the veins.

Similarly, if sections of a stem of *P. sinensis* be investigated they are found to contain a superficial peroxydase and a deep-seated peroxydase. As the result of investigating the peroxydases, not of any unknown variety taken at hazard, but of the several varieties characterised by constant differences of depth and extent of pigmentation, we have been able to show that the distribution of peroxydase in any one race coincides broadly with the distribution of pigment in the most pigmented races. In other words, in *P. sinensis* the peroxydase framework for pigmentation occurs throughout the species, and the building of the several colour varieties is determined by the activity of the factor for chromogen production. If we conceive of this factor as administered in a series of doses we can form a fair picture of the mode of evolution of the series of varieties characterised by increasing or decreasing amount of pigmentation of their vegetative parts.

On turning to investigate the peroxydases in white-flowered races of *P. sinensis*, we shall expect to find from analogy with the peroxydases of the stem that these agents of pigment-formation are not lacking from the corollas of recessive whites. The application of our reagents shows that this expectation is correct, and that those white-flowered races which lack the factor for colour contain epidermal and bundle peroxydase. Hence we conclude that the absence of colour from recessive white flowers is due, not to the absence of peroxydase, but to absence of chromogen. This conclusion is in conformity with that arrived at previously by Mendelian methods; for, as we have noted already, these methods demonstrate that anthocyan pigmentation of the flower of *P. sinensis* depends on the presence of one factor only, and that the absence of pigmentation which is characteristic of recessive whites is due to the absence of that single colour-factor.

The result of our investigation of the peroxydases of dominant white flowers is, on the other hand, quite different from that given by recessive whites. When corollas of dominant white races are treated with α-naphthol or benzidine and subsequently with hydrogen peroxide, they show no sign of peroxydase neither in epidermis nor in bundles. Hence such flowers either lack peroxydase or else they contain a substance which inhibits peroxydase from exercising its oxidising action on our oxydase-indicators.

That oxydases may be inhibited *in vitro* has been demonstrated already by Görtner, who has shown that the addition of certain phenolic compounds—orcin, resorcin, &c., prevents tyrosinase from exercising its characteristic action upon tyrosin.

Assuming that an inhibitor of peroxydase occurs in dominant white flowers, it may be supposed to act

either by destroying peroxydase or by setting up conditions under which the activity of peroxydase is arrested. Assuming further that the inhibitor acts in the latter way, it follows that if means of destroying or removing the inhibitor be discovered and employed, the peroxydase released from the inhibitory grip should be free to effect the oxidation of our reagents.

This train of reasoning gave us a point of departure for experiment. Starting from this point Dr. Armstrong and I have found in hydrogen cyanide a means of removing peroxydase-inhibition. Thus if dominant white flowers are immersed in a 0·4 per cent. solution of hydrogen cyanide for twenty-four hours, washed, and treated with either of our reagents together with hydrogen peroxide, pronounced peroxydase reactions are obtained, both in the epidermal and bundle tissues of the corolla. Carbon dioxide in aqueous solution produces a like, albeit a less pronounced effect.

Now, it so happened that we had at our disposal a race of primulas, the flowers of which lend themselves peculiarly well to the purpose of confirming these observations. The race in question is characterised by blue flowers with fairly symmetrically placed paired white patches on each petal. We have reason to believe from the known ancestry of this race that these white patches are produced by a localised inhibitor.

Corollas of these flowers treated with α-naphthol or benzidine become quite colourless. When, however, hydrogen peroxide is added the natural pattern is restored. The parts originally blue are stained lilac-blue or brown, according to the reagent used, and the inhibitory patches stand out as in the intact flower as white areas on the coloured ground.

If instead of submitting the parti-coloured flowers directly to the oxydase reagent they are treated first with hydrogen cyanide, and then treated with the reagent and subsequently with hydrogen peroxide, the inhibition located in the white areas is found to have been removed, and the peroxydase reaction is produced over blue and white areas alike.

Hence the Mendelian hypothesis of the inhibitory nature of dominant whites is confirmed by biochemical methods. Moreover, these methods demonstrate that the inhibitor acts not by destroying but by preventing the action of oxydase upon the chromogen.

There are many other aspects presented by the phenomena of oxydase distribution in *P. sinensis* and other plants which we have investigated. Some I may enumerate, but lack of time must be my excuse for not dealing fully with any of them.

The close proximity in the flower of the superficial and deep oxydases suggests that the latter may co-operate with the former in producing flower-pigments. This possibility entails the hypothesis of a translocation of oxydase from the region in which it is secreted to that in which it acts, and there are not a few facts which are in favour of this view; for example, the lines of deep colour which occur along the veins of many flowers, the frequency with which the walls of cells appear to contain oxydase, the occurrence of oxydase in the mesophyll cells which adjoin the bundle sheath, and the evidence provided by the mutual influence of stock and scion in grafted plants and in graft hybrids. Though these and other subjects must be passed over, I cannot resist giving what appears to me to be the most elegant mode of demonstrating the relation between oxydases and pigmentation which we have as yet observed. The plant which has served for this purpose is the sweet William (*Dianthus barbatus*), and any of the old-fashioned races of this plant common in cottage gardens suffices, provided that it be an ever-sporting race. Such a race is known by the fact that it bears, on one and the same head, flowers of different colours. The race which we have used is very sporting, a single plant bearing in one inflorescence deep magenta, pale magenta, white with limited rose flush, and all but pure white flowers.

If a petal of each of these flowers be treated with the benzidine reagent, it is found that the extent and amount of the oxydase reaction, as measured by the distribution and depth of brown coloration indicative of oxydase, coincide precisely with the extent and amount of pigmentation. The full-coloured petal gives a uniform deep brown reaction, the light magenta a uniform but paler reaction, the petal with a limited rosy flush gives a slight reaction, limited to the pigmented area, and the all-but-white petal gives none but the slightest reaction, and that only in the part of the petal which contained traces of pigment. Thus—unless the results are due to a partial inhibition which has eluded our attempts at demonstration—it would seem established that the ever-sporting habit is due to differences in the amount of oxydase in the diversely coloured flowers.

The sweet William is also noteworthy in that it contains white races, some of which give an oxydase reaction in their petals, and some of which give no oxydase reaction. Breeding experiments now in progress will decide whether or no these white races, like those of sweet peas investigated by Bateson and Punnett, mated together yield coloured progeny. If so, the factors for colour, long wandering yet not lost, which meet again in reversionary coloured cross-breeds, may prove to be a chromogen factor and an oxydase factor.

Finally, a brief reference must be made to our observations on the periodic fluctuation of oxydase in plants. Various observers have noticed that plant tissues give the peroxydase reaction much more generally than the oxydase reaction. The observations now to be described indicate that this is due to the greater stability of peroxydase as compared with the organic peroxide.

In certain circumstances a tissue which gives only the peroxydase reaction may exhibit the direct oxydase reaction. Moreover, the extent of the peroxydase reaction, as judged by the depth of coloration of the reagent, varies in similar plants at different times.

Inquiry into the meaning of these fluctuations led us to the discovery that the nature and amount of oxydase contained in a plant tissue varies in an orderly manner according to external conditions.

Among the conditions which determine this fluctuation are light and darkness. Plants subjected to normal illumination possess less oxydase than those which are kept in darkness. After one or two days' exposure to darkness plants of *P. sinensis* contain more peroxydase than sister plants kept under normal conditions of illumination. Moreover, after such an exposure to darkness tissues which under normal conditions give only peroxydase-reactions yield distinct oxydase-reactions.

Whether these phenomena are general among plants we are not yet in a position to say; but repeated experiment enables us to vouch for them in the case of *P. sinensis*. Should the results of similar investigations with other plants show that this diurnal variation of the oxydase-content of plant tissues is of general occurrence, we may perhaps discover therein the means whereby many of the phenomena of periodicity exhibited by plants are maintained and regulated. We know that the light and darkness of the day and night set up rhythms in the plant; for example, that the leaves of various plants assume nocturnal and diurnal positions. We know further

that the rhythm thus established may be maintained for a certain time under uniform conditions of illumination. This is the case with the sensitive plant and many another.

Animals also exhibit a like periodicity. Thus some years ago Dr. Gamble and I showed that certain shrimp-like animals, *Hippolyte varians*, roll up their brilliant chromatophores at night and assume a sky-blue colour. When daylight comes they put on their daytime dress by spreading out the pigment of their chromatophores in far-reaching superficial networks. Kept in the dark, these animals retain for many days this periodic habit, and when the hour of night arrives, although they have no light to tell it by, they lay aside their daily garb and put on the uniform of night. So also the plant-animal *Convoluta roscoffensis*, which lives on the seashore, orders its behaviour by the sun and moon. It lies on the sand till the waves of the making tide are upon it, and then descends to security and darkness. When the tide recedes it rises to the light. Even the uncongenial surroundings of a teacup and a laboratory fail to break this habit; for in these surroundings its uprisings and down-lyings keep time with the tides.

To one who has scrutinised with perplexed mind these mysteries of biology, the speculation may be permitted that light and darkness may work these wonders through the control of chemical agents such as oxydases. But though it be legitimate to make a speculation of this kind, it is idle to hunt the unknown to the death without the lethal weapon of experiment, and so I leave it for the present unpursued, and with it my address. We have it on the authority of a poet and philosopher that to the traveller on a lonely road each bush becomes a bear, and I am not oblivious of the fact that oxydases have obtruded themselves with a certain obstinacy in the course of my address. Nevertheless, obsession has its uses and significance, for it is the after-effect of enthusiasm; and though I have dealt, perhaps at undue length, with special problems and with suggestions, I venture to think that I have made out my case for the opportuneness of an *entente cordiale* between physiology and Mendelism.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The Henry Sidgwick memorial lecture at Newnham College will be given by Prof. Ward in the College Hall on Saturday, November 9, at 5 p.m., and will be open to all. The subject will be "Heredity and Memory."

The prize of 50*l.* out of the Gordon Wigan Fund for a research in chemistry has been awarded to D. H. Peacock, of Trinity College, for investigations on "Hydroxyhydrindenehydrazine and its Resolution," "1 : 2 : 4-Triketopentamethylene," and "The Theory of Molecular Volumes."

The next combined examination for fifty-seven entrance scholarships and a large number of exhibitions, at Pembroke, Gonville and Caius, Jesus, Christ's, St. John's, and Emmanuel Colleges, will be held on Tuesday, December 3, and following days. Mathematics, classics, natural sciences, and history will be the subjects of examination at all the above-mentioned colleges. A candidate for a scholarship or exhibition at any of the six colleges must not be more than nineteen years of age on October 1, 1912. Forms of application for admission to the examination at the respective colleges may be obtained as follows:—Pembroke College, The Master; Gonville and Caius College, the Master; Jesus College, A. Gray; Christ's College, the Master; St. John's College, the Master; Emmanuel College, the Master; from any of whom further information respecting the scholarships and other matters connected with the several colleges may be obtained. The forms of application must be sent in on or before Saturday, November 23.

Colonel Harding, of Madingley Hall, has offered to the Vice-Chancellor to hand over to the University a sum which will produce an annual income of between 50*l.* and 60*l.* a year, to be devoted to the payment of a lectureship in zoology.

A SERIES of ten free public lectures upon natural history, folk-lore, and related subjects will be given in the new Lecture Hall of the Horniman Museum, Forest Hill, S.E., at 3.30 o'clock on Saturday afternoons, commencing October 12.

IT is stated in *Science* that at the September meeting of the Yale Corporation it was announced that since the last meeting three wills have been filed for probate from which Yale University will probably receive during the year about 150,000*l.* These bequests include 50,000*l.*, unrestricted, by bequest of Mr. Matthew C. D. Borden, and the McPherson fund of between 80,000*l.* and 100,000*l.*, "to be employed in assisting worthy indigent students."

A COPY of the second issue of the "Register of Old Students of the Royal College of Science, London," compiled by the Old Students' Association, has been received. An excellently reproduced photograph of Sir William Crookes, O.M., F.R.S., the president of the association, serves as a frontispiece to the register. The names of 876 old students are given; of these 729 are associates of the college, and in their cases the subjects in which they took their diplomas are enumerated. Copies of the register may be obtained, price 1*s.* net, from Messrs. Lamley and Co., Exhibition Road, South Kensington.

THE Secretary of State for India in Council has made the following appointments to the Indian Educational Service:—Dr. W. N. F. Woodland to be professor of zoology at the Muir Central College, Allahabad; Dr. A. N. Meldrum to be professor of physics and chemistry at the Institute of Science, Ahmedabad; Mr. W. S. Rowlands to be professor of philosophy at the Government College, Jubbulpore; Mr. G. H. Luce to be professor of English at the Government College, Rangoon; and Mr. C. S. Gibson to be additional professor of chemistry at his Highness the Maharaja's College, Trivandrum, in the Travancore State Service.

AT the University of Leeds on October 3 honorary degrees were conferred upon Mr. Arthur Cooper, president of the Iron and Steel Institute; Sir Robert Hadfield, F.R.S., a past president of the institute; M. Adolphe Greiner, of Liége; Herr Friedrich Springorum and Mr. J. E. Stead, F.R.S., members of the council of the institute; Mr. Corbet Woodall, Mr. Charles Carpenter, and Mr. Thomas Newbigging, for their services to science in the gas industry; and Sir Swire Smith, Mrs. R. W. Eddison, Mr. W. E. Garforth, and the Rev. W. H. Keeling, headmaster of Bradford Grammar School, for their services to science and education in Yorkshire.

THE students of forestry in Edinburgh University, as part of their practical training, have during August and September been camping out at the Drumbuick Wood, Methven, Perthshire, and part of the Logie-almond estate of the Earl of Mansfield, so as to have the opportunity of measuring timber. The trees were principally Scots pine, larch, and spruce, and these were numbered and measured. The accessible trees were dealt with in detail in 10-ft. sections, while

every tenth was barked so as to obtain the allowance necessary to be made for bark. The work of the students was supervised by Mr. Lyford-Pike, junior lecturer in the University, who was assisted by a few recent graduates in forestry.

DR. L. SILBERSTEIN will commence a course of twelve lectures on "The Theory of Relativity" at University College, Gower Street, W.C., to-morrow, October 11, at 5 p.m. The first part of the course will be historical, beginning with Maxwell's electromagnetic theory, and the Hertz-Heaviside equations; the second part will be concerned with the principle itself; and the third with its applications and recent extensions. Much attention has been paid to the subject since Einstein founded the modern theory in 1905, but the arguments for the principle, and the conclusions to which they lead, are not well understood. There must be many students of physics who will be glad to have a clear and connected statement of a theory which, carried to its furthest extent, would declare that "the phenomena of physical science do not lead us to any knowledge of a permanent and unique frame of reference relative to which the motions of bodies may be determined."

COPIES of the calendar for the academic year, 1912–13, of the University of Leeds are now available. As is natural in the case of a great modern university, the faculties of science and technology take a prominent place in the activities connected with the institution. The degree of bachelor of science, whether with or without honours, may be taken in pure or applied science. The student wishing to graduate on the technical side may study mechanical, civil, electrical, mining, or gas engineering, fuel and metallurgy, agriculture, colour chemistry and dyeing, or the chemistry of leather manufacture, and, if successful, secure his degree. In addition, the University grants diplomas in certain circumstances in the branches of applied science in which degrees are awarded, and also in textile design and cloth finishing, in woollen and worsted spinning, cloth manufacture, and textile chemistry. Evening classes in a wide range of subjects are also provided for students whose time is occupied in industrial pursuits during the day.

AN interesting short history of Bedford College for Women is included in the calendar for the sixty-fourth session, that of 1912–13, of the college, which was recognised in 1900 as a school of the University of London in the faculties of arts and science. It will be remembered that a bequest in 1908 of 11,500*l.* from the late Mr. R. J. Turle enabled the council in the same year to purchase the end of the lease of South Villa, Regent's Park, for the sum of 15,000*l.*, a promise from the Crown having been obtained of a new lease for 99 years. The site is an ideal one. New buildings, for which Mr. Basil Champneys has been appointed architect, and will include a library, laboratories, lecture rooms, and a residence for students, are now in course of erection, and it is hoped that they will be ready for occupation by next Easter. It is estimated that the cost of the undertaking will amount to about 115,000*l.*, including 18,000*l.* which has been expended in connection with the purchase of the lease of the new site. The total sum given and promised amounts to 130,000*l.*, which leaves 15,000*l.* to form the nucleus of an endowment fund.

THE calendar of the North of Scotland College of Agriculture for the session 1912–13 points out that the classes of the college are held in the University of Aberdeen, with the exception of the class in agricultural engineering, which meets in Robert Gordon's Technical College. The courses of instruction provided are arranged for the benefit of every section of the agricultural community. The lectures, in the branches of agriculture and agricultural chemistry, are arranged in a series of three years with the view of giving full treatment to these subjects. Students unable to spare the time for a long course in agricultural science, but who can spare five months in winter, have an opportunity of obtaining a diploma in agriculture conferred by the University. Young men and women who wish to qualify themselves as agricultural teachers or as specialists in some branch of agricultural science may obtain the degree of bachelor of science of the University on passing the preliminary examination of the University and two professional examinations. Extended courses of lectures in forestry are arranged for those desirous of training as factors and land stewards; courses for teachers in school gardening and other subjects required in rural districts are provided, and every effort is being made to supply suitable technical education for the district.

THE *London University Gazette* for September 25 announces a number of courses of advanced lectures in various subjects, among them being a course of three or four lectures on "The Theory of the Solid State," by Prof. W. Nernst, professor of physical chemistry and director of the Institute of Physical Chemistry in the University of Berlin. Other courses to be delivered during the session are:—The fundamental chemical processes of plant life, Prof. H. E. Armstrong, F.R.S.; the Gnetales, Prof. M. J. Benson; the permeability of protoplasm, F. F. Blackman, F.R.S.; the activities of green plants in relation to light, Harold Wager, F.R.S.; meteorology in relation to the navigation of the air, Dr. W. N. Shaw, F.R.S.; the action of enzymes, Prof. W. M. Bayliss, F.R.S.; the physiology of the mammalian heart, Dr. F. S. Locke; protozoa, Prof. E. A. Minchin, F.R.S.; the growth of the vertebrate embryo, R. Assheton; recent work on experimental embryology, Dr. J. W. Jenkinson; mimicry and protective resemblance, Prof. E. B. Poulton, F.R.S.; the evolution of the mammary apparatus in the mammalia, Prof. E. Bresslau, of Strassburg; growth and form, Prof. D'Arcy Thompson, C.B.; the advanced metallurgy of gold, silver, copper, lead, &c., Prof. W. Gowland, F.R.S.

SOCIETIES AND ACADEMIES.

PARIS.

Academy of Sciences, September 30.—M. Émile Picard in the chair.—Edmond **Perrier**: The skull known as that of Descartes in the museum. Reasons are given for the probable authenticity of this skull.—Pierre **Termier**: The scientific results of the Alpine excursion of the Geologische Vereinigung; the lepontine strata to the west of Innsbruck.—M. **Gouy**: A particular kind of electric currents. A non-electrified body is usually regarded as carrying equal charges of the two kinds of electricity. The latter, according to current views, are carried by particles possessing a certain independence, and under certain conditions may move with different velocities. If this is the case, the movement of a non-electrified body may give rise to an electric convection current, producing its ordinary effects. This view is applied to the case of incandescent gases in motion.—M. **Arnaud**: Astronomical refraction in the neighbourhood of the horizon.—Em. **Bourquelot** and Mlle. A. **Fichtenholz**: The presence of quebrachite in the leaves of *Grevillea robusta*. The fresh leaves contain more than 4 grams of quebrachite per kilogram, or four times the amount extracted from the bark of

C. tanret. Details are given of the method of extraction and of the chemical and physical properties of the quebrachite.—A. **Fernbach**: A new form of soluble starch. Weak solutions of starch in water, not containing more than 2 per cent. of starch, are poured into a large excess of acetone, and the precipitate extracted with pure acetone, and dried in a vacuum. The starch thus obtained is distinguished by the property of dissolving easily in cold water, and this solution yields with iodine very pure blue colorations.—J. **Wolff**: Some new properties of the peroxydases and their mode of working in the absence of peroxide.—Jacques **Parisot** and M. **Vernier**: Researches on the toxicity of fungi. Their hæmolytic power. It is shown that the hæmolytic power of fungi, when it exists, is very strong, both *in vitro* and *in vivo*. This property is possessed by some of the edible fungi, and it is pointed out that a very long exposure to a high temperature during cooking is required to destroy this poisonous property.—Maurice **Lugeon**: The tectonic of the Morcles strata and its consequences.—De Montessus de **Ballore**: Seismological observations made at the island of Pâques.—Henry **Hubert**: The aërial currents in western Africa.

BOOKS RECEIVED.

Einführung in die Mathematik für Biologen und Chemiker. Prof. L. Michaelis. Pp. vii+253. (Berlin: J. Springer.) 7.80 marks.

The Cambridge Manuals of Science and Literature: The Individual in the Animal Kingdom. By J. S. Huxley. Pp. xi+167. The Work of Rain and Rivers. By Prof. T. G. Bonney. Pp. viii+144. The Psychology of Insanity. By Dr. B. Hart. Pp. ix+176. House-flies and How they Spread Disease. By Dr. C. G. Hewitt. Pp. xii+122. Brewing. By A. C. Chapman. Pp. xi+130. Heredity in the Light of Recent Research. By L. Doncaster. Second edition. Pp. x+160. (Cambridge University Press.) 1*s.* net each.

Die Existenz der Moleküle. By Prof. T. Svedberg. Pp. viii+243+4 plates. (Leipzig: Akademische Verlagsgesellschaft m.b.H.) 12 marks.

Untersuchungen über die Bildungsverhältnisse der ozeanischen Salzablagerungen insbesondere des Stassfurter Salzlagers. By J. H. van't Hoff and others. Edited by Profs. H. Precht and E. Cohen. Pp. xx+374+8 plates. (Leipzig: Akademische Verlagsgesellschaft m.b.H.) 16 marks.

Sylviculture in the Tropics. By A. F. Broun. Pp. xviii+309. (London: Macmillan and Co., Ltd.) 8*s.* 6*d.* net.

La Cementazione dell' Acciaio. By Dr. F. Giolitti. Pp. xi+506. (Torino: Unione Tipografico-Editrice Torinese.)

Handbuch der Spectroscopie. By Prof. H. Kayser. Sechster Band. Pp. vi+1067. (Leipzig: S. Hirzel.)

Hypnotism and Disease. By Dr. H. C. Miller. Pp. 252. (London: T. Fisher Unwin.) 5*s.* net.

Survey of India. Professional Paper, No. 13: Investigation of the Theory of Isostasy in India. By Major H. L. Crosthwait. Pp. iii+14+map. (Dehra Dun: Trigonometrical Survey of India.)

Biomechanik und Biogenesis. By Prof. M. Benedikt. Pp. iii+88. (Jena: G. Fischer.) 2 marks.

Richtlinien des Entwicklungs- und Vererbungsproblems. By Dr. A. Greil. Zweiter Teil. Pp. iii+364. (Jena: G. Fischer.) 10 marks.

Junior Sound and Light. By Drs. R. W. Stewart and J. Satterly. Pp. 227. (London: W. B. Clive.) 2*s.* 6*d.*

The Marine Mammals in the Anatomical Museum of the University of Edinburgh. By Sir W. Turner. Pp. xv+207. (London: Macmillan and Co., Ltd.) 6*s.* net.

Narrative of the Visit to India of their Majesties King George V. and Queen Mary, and of the Coronation Durbar held at Delhi, December 12, 1911. By the Hon. J. Fortescue. Pp. viii+324. (London: Macmillan and Co., Ltd.) 10*s.* 6*d.* net.

The Theory of Light. By the late Prof. T. Preston. Fourth edition. Edited by Prof. W. E. Thrift. Pp. xxiii+618. (London: Macmillan and Co., Ltd.) 15*s.* net.

Education and National Life. By Dr. H. Dyer. Pp. 112. (London: Blackie and Son, Ltd.) 1*s.* net.

Vibration and Life. By Dr. D. T. Smith. Pp. 178. (Boston: R. G. Badger.) 1.50 dollars net.

The Composition of the Atmosphere: with Special Reference to its Oxygen Content. By F. G. Benedict. Pp. iii+115. (Washington: Carnegie Institution.)

A Bicycle Ergometer with an Electric Brake. By F. G. Benedict and W. G. Cady. Pp. iii+44. (Washington: Carnegie Institution.)

The Production of Elliptic Interferences in Relation to Interferometry. By C. Barus. Part ii. Pp. vi+79–168. (Washington: Carnegie Institution.)

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