THURSDAY, FEBRUARY 2, 1905.

THE QUINTESSENCE OF HAECKELISMUS.

The Wonders of Life. A Popular Study of Biological Philosophy. Supplementary volume to "The Riddle of the Universe." By Ernst Haeckel. Translated by Joseph McCabe. Pp. xiv+501. (London: Watts and Co., 1904.) Price 6*s.* net.

THIS new book by the indefatigable Haeckel is supplementary to his "Riddle of the Universe." That several hundred thousand copies of the "Riddle" were sold indicates the widespread interest taken in what the author calls "the construction of a rational and solid philosophy of life," or in what others would call an extremely biological way of looking at things. But the "Riddle" and its solutions raised storms of criticisms and evoked hundreds of reviews—both friendly and hostile—besides many large pamphlets and even a few books, not to speak of more than five thousand letters. To these collectively, friends and foes alike, Haeckel now replies in this "biological sketch-book," written uninterruptedly in the course of four months when he was completing his seventieth year in a vacation at Rapallo, a tiny coast-town of the Italian Riviera. He had leisure there to think over all the views on organic life which he had formed in the course of a many-sided experience of life and learning since the beginning of his academic studies (1852) and his teaching at Jena (1861). The constant sight of the blue Mediterranean, the animal inhabitants of which he knows so well, his solitary walks in the wild gorges of the Ligurian Apennines, and the moving spectacle of the "forest-crowned mountain altars," inspired him with "*a feeling of the unity of living nature*—a feeling that only too easily fades away in the study of detail in the laboratory." He hopes that his readers may be moved by his book "to penetrate deeper and deeper into the glorious work of Nature, and to reach the insight of our greatest German natural philosopher, Goethe:

> "What greater thing in life can man achieve
> Than that God-Nature be revealed to him?"

The work is described as "a popular study of biological philosophy"; it is divided into four sections—methodological, morphological, physiological, and genealogical, which deal respectively with the *knowledge* of life, the *nature* of life, the *functions* of life, and the *history* of life. It raises no end of perplexing problems—life and death, nutrition and reproduction, heredity and variation, sensation and intelligence, morality and religion. It discusses protoplasm and the cell, spontaneous generation and evolution in general, the "pro-morphology" of organisms and the intricate architecture of the brain, the recapitulation of phylogeny in ontogeny, the inheritance of acquired characters, the evolution of sensation, æsthesis, intelligence, and morality. In short, it comprises practically everything, including miracles, the religious thoughts of Mr. Romanes, the university curriculum, the increase of pauperism, the introduction of Spartan elimination-methods, the Apostles' Creed, the immaculate conception, immortality, and a belief in a personal God. A book with so large a purview is bound to be sketchy—and the author calls it "a biological sketch-book"—but sketchiness in dealing with subjects so momentous is apt to be unsatisfactory, and, while Haeckel continually and quite fairly refers to what he has said elsewhere in his large family of books, the discriminating reader may justly complain that he has often to deal rather with an assertion of convictions than with a reasoned argument. What carries one on from page to page is the feeling that we have to listen to a veteran who is telling us frankly and fearlessly what he believes to be true in regard to the order of nature and our place in it.

From one point of view Haeckel's discussion of the "Wonders of Life" is an apology for "Monism" or "Hylozoism." In studies of "unequal value and incomplete workmanship," as the illustrious author confesses, an attempt is made to show how we may attain to the conception of one great harmoniously working universe—"whether you call this Nature or Cosmos, World or God"—without utilising any knowledge which is not of empirical origin and *a posteriori*. We must not allow metaphysical fictions to intrude on our philosophy—still less into our science; we may work with the "law of substance," but there is to be no hocus-pocusing with transcendental formulæ; science is sufficient unto herself, and is justified of her children; criticism of her postulates and categories is a waste of time when there is so much to do; psychology is "a branch of physiology," and it is unprofitable to think about thinking; a "theory of knowledge" is a luxury for the leisured. Everything seems to become plain sailing if we embark on the craft "Hylozoism," but we require faith to help us across the gangway.

From another point of view Haeckel's book may be taken as an expression of the outlook on man and nature which may be reached by a conscientious pursuit of the scientific method. Those who remain agnostic or positivist in regard to either monism or dualism in any of their forms will be interested in hearing once more of the order, unity and progressiveness of nature's tactics, and in considering the practical proposals which a thorough-going Darwinian has to offer in regard to incapables and incurables, pauperism and crime. We cannot do more than remark that these proposals preach elimination rather than eugenics; they are more akin to surgery than to preventive medicine. Much of the book is, naturally enough, an echo of previous works—the "Monera," the "Gastræa Theory," the "Natural History of Creation," the "Evolution of Man," and, what has always appeared to us the author's *magnum opus*, the "Generelle Morphologie" (1866); but all has been modernised and orientated afresh to illustrate what Haeckel was so much impressed with at Rapallo, *the unity of living nature*. An interesting illustration of the author's artistic enthusiasm and indifference to popularity will be found in the pages on pro-morphology, wherein he discusses the architectural symmetries of organisms, as he did forty years ago. The centrostigmatic, centraxonial, and centroplane

types of architecture have some personal fascination for us, but they must be caviare to the general.

To illustrate more concretely the general tenor of the "Wonders of Life," we may refer, for a moment, to the first two chapters, on truth and on life. In the chapter on truth we are introduced to the "*phronema*," the organ of knowledge, a definite and limited part of the cerebral cortex, consisting of association-centres, the innumerable cells of which are the elementary organs of the cognitive process, the possibility of knowledge depending on their normal physical texture and chemical composition. *How* this august possibility depends on the organisation of the "phronetal cells" remains entirely obscure, and no amount of "bluffing" will lessen this obscurity. As to life in general, its phenomena are determined by the physicochemical organisation of the living matter; metabolism has its analogue in inorganic catalysis; reproduction is analogous to the "elective multiplication" of crystals; and sensation is a general form of the energy of substance, not specifically different in sensitive organisms and irritable inorganic objects (such as dynamite). It is unfortunate, however, for this view of things that we cannot at present interpret even the simplest vital phenomenon in terms of physical and chemical formulæ. But we must remember that while "there is no such thing as an immaterial soul," a "soul" in the atom "must necessarily be assumed to explain the simplest physical and chemical processes." It seems to us six of one and half a dozen of the other whether we recognise the soul at the top or at the bottom. In Aristotelian language, there is nothing in the end which was not also in the beginning; in plain English, we put into the beginning what we know to be in the end. In fact, when we pass from the descriptive, formulative, interpretative task of science to philosophical explanation—whether monistic or dualistic—we load our intellectual dice. The only alternative is positivism, which is not amusing, and refuses to play. Haeckel's monism, we are bound to confess, appears to us to be dualism in disguise. He predicates for his "substance"—which is from everlasting to everlasting—a trinity of fundamental attributes, matter, energy, *and* sensation.

It is one of Haeckel's pastimes to coin new words, and now and again he has hit on a term which has been really useful, and has come to stay. In his "Wonders" his verbose inventiveness is still manifest. For the sciences which deal with inanimate nature a term is needed, and we are invited to choose between abiology, anorganology, abiotik, and anorgik, each of which seems worse than its neighbour. "Ergology" we might digest, but when it comes to perilogy, metasitism, trophonomy, tocogony, gonimatology, plasmodomism, and metaplasmosisms, the suggestion of an emetic is so obvious that we cannot swallow them.

We wish to make a remark in regard to the translation. Haeckel's preface is dated June 17, 1904, and this means that the translation has been accomplished with quite remarkable rapidity. It is on the whole clear and vigorous, but it betrays inexpertness. Thus we would point out the undesirability of calling Acanthocephala "itch-worms," or Cirripedia "creeping-crabs" or "crawling crabs," or Arion "our common garden snail," or Holothurians "sea-gherkins," and we could add to this list considerably. There seems something wrong, too, in calling reproduction "*transgressive* growth," and we wonder what "wonder-snails" can be, or "the actinia among the tunicates." In regard to the articulation of the lower jaw in mammals, we learn that "this joint is temporal and so distinguished from the square joint of other vertebrates." "Square" is a quaint way of referring to the quadrate bone! The translator has not the vaguest idea what he is translating. Defective proof-reading introduces us to a number of strangers, such as an early microscopist "Crew" in England and a prominent modern biologist who is always referred to as "De Bries." We are interested also in a renowned physiologist called Felix Bernard, and in what Wilhelm Preyer did "for the plant." Such is fame! Beside these, misprints like Cecidomyca, Ichtyosauri, and diatomes are trivial. It is a very unusual proceeding to print every technical name of class, genus, or species in italics without capitals.

In conclusion, while we entirely disagree with Haeckel's treatment of philosophy, and believe that he has not justly realised what its office is, while we also disagree with some of Haeckel's science, *e.g.* the transmission of acquired characters, we desire to point out that this book expresses the sincere convictions of a veteran who has done much for biology, and that its aim is to help towards including "all the exuberant phenomena of organic life in one general scheme, and explaining all the wonders of life from the monistic point of view, as forms of one great harmoniously working universe—where you call this Nature or Cosmos, World or God." As Browning said, our reach should exceed our grasp, "else what's Heaven for?"

A USEFUL BOOK FOR FRUIT GROWERS.

The Culture of Fruit Trees in Pots. By Josh Brace. Pp. x+110. (London: John Murray, 1904.) Price 5*s.* net.

IT is nearly half a century since the late Thomas Rivers built glass structures for the protection of his fruit trees in pots. He was led to do this because in several successive seasons the hardy fruit crops were almost destroyed by severe frosts, which occurred when the trees were in flower—a very critical stage in the growth of the trees. Mr. Rivers was convinced that in order to be certain of obtaining crops of first-rate fruit of peaches, nectarines, apricots, plums, cherries, and even apples and pears, it was necessary to have large glass structures to protect the trees at that period. These early houses were not provided with means of heating them artificially, because it was then thought that the extra expense this would have entailed was unnecessary; but subsequent experience proved that a flow and return hot water pipe in each house not only provided additional security against frost, but the slight heat thus obtainable, if employed in bad weather while the trees are in flower, has a

good effect upon the pollen, and therefore assists in securing the fertilisation of the flowers.

Since that time the pot fruit trees cultivated in the Sawbridgeworth nurseries of Messrs. T. Rivers and Son have provided a unique object lesson to British fruit growers, and the system has been imitated in other commercial establishments and in many private gardens, a notable instance being the gardens belonging to Mr. Leopold de Rothschild at Gunnersbury House, Acton, where excellent results are obtained notwithstanding the fact that the gardens are in London. The author of the book under review has been charged with the care of the orchard houses at Sawbridgeworth for more than twenty years, and the details of cultivation he explains are those which have been practised with such conspicuous success in that establishment. It may be admitted that the orchard house is more necessary in the colder districts of midland and northern counties than in the south, but even in the south the season of ripe fruits can be prolonged by orchard house culture, and more perfectly developed apples and pears obtained for particular purposes. Who that has seen the exquisite specimens exhibited at the autumn fruit shows has not wished to cultivate fruits of similar excellence? It is the mission of Mr. Brace's book to assist the reader to accomplish this purpose.

In the first chapter the author has described very minutely the construction of the best type of houses, and the importance of commencing with suitable structures is so great that we are not disposed to complain that the subject occupies one-fifth of the book, as well as several diagrams. From every point of view houses with span-shaped roofs are best, and if Mr. Brace's instructions are studied, the cultivator, by moving his trees out of doors at suitable periods, will be able to make the most of the space afforded in the houses.

In chapter ii., in which the furnishing of the houses with trees is considered, the best methods of arranging them are described, so that as many trees may be grown as possible, and yet none be obscured by the others. If only one house is built, and this is of an appreciable size, it should be divided into sections, because peaches and nectarines can be treated more successfully when grouped by themselves, as the trees need to be syringed daily until the fruits begin to ripen, which would not be possible if cherries or plums, which ripen much earlier in the season, were associated with them in the same division.

Chapter iii. must be read very carefully, and should be frequently referred to by the inexperienced cultivator. It contains details of cultivation, explains the best forms of training for the different kinds of trees, the process of potting, methods of forcing, pruning, summer pinching, value of surface dressings to the roots, cost of trees, &c. In the cultivation of fruit trees in pots, whether half standards, or bush trees of peaches, nectarines, and plums, or pyramids of apples and pears, the work of pruning and pinching is of the greatest importance, and if it be done unskilfully not only will the trees be unshapely and the fruit spurs become longer than is desirable, but the trees will fail to contain sufficient fruitful wood to produce satisfactory crops.

The best varieties of the different kinds of fruits for pot culture are described in chapters iv. and vii., and in chapter v. the subject of insect pests is dealt with, and the measures to adopt against these and the peach mildew are explained. Chapter vi. consists of a brief calendar of operations in the unheated orchard house for each month of the year, which is sufficient to remind the practitioner of the correct time to carry out the operations which are more fully described in the previous pages.

In addition to other illustrations, the work is adorned with full-page plates representing pot fruit trees in bearing, being reproductions from photographs obtained in Messrs. Rivers' nursery. These are reproduced in the very best manner, and the printing throughout the book is clear, and the type large and distinct.

The book has little claim from a literary point of view, but the author has described in plain words a system of cultivating fruit trees in pots which, if faithfully followed, will be attended with absolute success.

R. H. P.

A TRAVELLER'S COMPANION.

Stanford's Geological Atlas of Great Britain (based on Reynolds's Geological Atlas). By Horace B. Woodward, F.R.S., F.G.S. Pp. x+140; with 34 coloured maps and 16 plates of fossils. (London: E. Stanford, 1904.) Price 12*s.* 6*d.* net.

THIS work is a re-written and revised edition of the well known atlas, which was long a familiar object to the students of shop-windows near Temple Bar, associated as it was with geological diagrams of a highly venerable aspect. It was always attractive by its very neatness and compactness, and has gained further in these respects under Mr. Stanford's care. The maps are printed in colours, and the concluding plates of fossils, reproducing for the most part Mr. Lowry's refined workmanship, are almost as delicate as the engraved originals, which were published in 1853. These plates, by the by, are not now arranged so consecutively as could be desired. Mr. H. B. Woodward has brought the text up to a modern standpoint, and we note references to the Pendleside series, to the Mesozoic rocks in a volcanic vent in Arran, and to the occurrence of Pliocene mammalian remains in a fissure in Derbyshire—all matters of very recent history. The Upper Greensand and Gault are described and mapped together as Selbornian, a combination of great stratigraphical convenience, however much it departs from the petrological and geognostic mapping of early days. Here we see at once how the philosophic view of "organised fossils," introduced by William Smith, has made two types of geological maps necessary, one for the students of the earth's history, and one for the engineers, landowners, and agriculturists, to whom Smith made his first appeal. Luckily, in our British Isles, our "drift" maps, on a reasonable scale, go far to satisfy both requirements.

Mr. Woodward's descriptions of the various counties contain rather too much matter that could be discovered from the maps themselves. Though dealing with a land of most fascinating variety, they do not always rise to the demands made by the salient scenic features. Yet these are the features that strike the common traveller, to whom this work must always be a boon. From his point of view we have read the account of Gloucestershire a second time, and, of course, discover nothing to add, while we are grateful for a good deal of graphic description, tersely worded. The matter probably only needs a new arrangement, so that the reader who descends in imagination or in memory from the steep side of the Forest of Dean, and wonders at the great scarp of the Cotteswolds, facing him ten miles off across the Severn, is not dragged aside to learn that Coal-measures were discovered in the Severn Tunnel, and the irritating fact that "sulphate of strontium is worked at Wickwar in the Keuper Marl." The traveller wants to move forward; the open landscape lies before him; when he has gained his first broad physiographic view, he will condescend to search for fossils, and to rejoice in geodes of celestine.

The exceptional knowledge of the country possessed by the author is apparent in all these careful pages. He has added, moreover, exceedingly practical descriptions of the geology that is to be learned along the main lines of British railways. His views on the nomenclature of fossils are known from his published writings; but, while most of us are sadly inconsistent, he yields perhaps too little to the purists. If Mr. Woodward goes so far as Doryderma and Cœlonautilus, where none will blame him, why does he retain Ammonites and Goniatites as unrestricted generic names? Why *Echinocorys scutatus*, which seems to surpass the historical acuteness of Mr. C. D. Sherborn (see "Index to Zones of the White Chalk," *Proc.* Geol. Association, June, 1904), and, side by side with it, *Galerites albogalerus?* We doubt also Protocardium for Protocardia; but these matters are outside the main intention of the atlas. As a companion in Great Britain, this handy book is to be recommended to every traveller. The complete revision of the Scotch map, which is now so admirable, despite its comparatively small scale, makes us hope that Ireland, as a country of equal interest and variety, may be included in the next edition. G. A. J. C.

THE TEACHING OF SCIENCE.

The Preparation of the Child for Science. By M. E. Boole. Pp. 157. (Oxford: Clarendon Press, 1904.) Price 2*s.* 6*d.*

Special Method in Elementary Science for the Common School. By Charles A. McMurry, Ph.D. Pp. ix+275. (New York: The Macmillan Company, 1904.) Price 3*s.* 6*d.* net.

A GREAT change in the character of the books concerned with the teaching of science has taken place during the last twenty years or so. A quarter of a century ago the claims of science to a place in the school curriculum were being advocated vigorously, and men of science had still to convince reigning schoolmasters that no education was complete which ignored the growth of natural knowledge and failed to recognise that an acquaintance with the phenomena of nature is necessary to intelligent living. Speaking broadly, it may be said that most classicists even admit now that there are faculties of the human mind which are best developed by practice in observation and experiment. One consequence of the success which has followed the persistent efforts of Huxley and his followers—to secure in the school an adequate recognition of the educative power of science—has been that modern books on science teaching are concerned almost entirely with inquiries into the best methods of instructing young people, by means of practical exercises, how to observe accurately and to reason intelligently.

Mrs. Boole deals with the earliest education of the child, and gives a great deal of attention to the years which precede school life. Her book may be warmly recommended to parents anxious to adopt sane methods of educating their children and to teachers responsible for the training of the lowest classes of schools. Mrs. Boole rightly insists that the development in the child of the right attitude towards knowledge is of more importance during early years than the actual teaching. We agree with her, too, that "the best science teacher is usually a thorough-going enthusiast in the science itself, who in the intervals of regular teaching, gets his pupils to assist him in his own investigations or pursuits." But, unfortunately, the teaching profession is at present hardly attractive enough to secure the services of a sufficient number of ordinarily well educated men, and we shall have to wait a long time before we can expect to find many men of science engaged upon original research also teaching science to children in schools. Mrs. Boole's little book deserves to be read widely.

Like many other American educationists, Dr. McMurry attempts to do too much for the teacher. The larger part of his book is devoted to "illustrative lessons" and "the course of study," minute instructions being given as to what science subjects should be taught in each of the terms of each of the years spent by children in the elementary school. The teacher will deal most satisfactorily with those subjects of science he knows best, and in which he is most interested. From the point of view of the British teacher at least, it is inadvisable to attempt to impose a detailed scheme of work drawn up by somebody in another district and unfamiliar with the precise conditions and environment of the school in which the science teaching is to be done. Even if this were not the case, Dr. McMurry's scheme of work expects the class to accomplish far more in a term than can be studied satisfactorily in that period. Moreover, subjects too diverse, and hardly at all related one to the other, are prescribed for a single term. But Dr. McMurry's ideal is better than his practice; he says:—"it is easy for us to expect too much from formal method. The atmosphere which the teacher diffuses about him by his own interest and absorption in nature studies is more potent than any of the devices of method." A. T. S.

OUR BOOK SHELF.

The Basic Law of Vocal Utterance. By Emil Sutro. Pp. 124. (London: Kegan Paul and Co., Ltd., n.d.)

Duality of Voice and Speech. An Outline of Original Research. Pp. vi+224. (London: Kegan Paul and Co., Ltd., n.d.)

Duality of Thought and Language. An Outline of Original Research. Pp. viij+277. (London: Kegan Paul and Co., Ltd., n.d.)

THE first of these volumes, which was originally published in America in 1894, contains the starting point and main beliefs of the author; the second and third volumes form the amplification and illustration. Beginning with the practical problem of finding how a foreigner, especially a German, can learn to speak English correctly, Mr. Sutro has gone on until he has become convinced that he has discovered several most important scientific truths, and that he has a great mission to carry out in proclaiming them.

Among the discoveries stated in these volumes the following may be mentioned. There are two streams in the air which is breathed, which keep separate, one being for respiration, the other for sound. A person who breathed correctly might use the air supplied by the sound current in such a way as to speak for ever without taking breath, were it not for fatigue. For English speech we inspire through trachea and expire through œsophagus; for German the direction is reversed. The author has discovered a new vocal cord in the lower jaw. Air passages are diffused through the body; it is through these that the emotional nature of sound is produced. The original source of tone production has its location in the lungs, the kidneys, and the bladder for the most part. For the utterance of a word representing a flower there is an impression made on the right side of the thigh, while the expression is on the left side just opposite, the order being reversed for the corresponding German word. Just how we breathe into and out of the pelvis the author expects to explain satisfactorily in a future volume. Statements such as these, together with philosophical reflections and practical discussions as to the way in which the production of different sounds should be managed, fill the three volumes.

The volumes are not without a certain kind of interest—that of observing the process by which a man, who is evidently in earnest, comes to elaborate and believe such nonsense. It is at the same time possible that there may be in the remarks regarding the way in which sounds should be produced something which would be suggestive to one engaged in the practical work of teaching in this subject. According to Mr. Sutro, America has left his works almost unnoticed, while Germany has given a more favourable reception to them. It appears that an International Physio-Psychic Society has been founded for the propagation of the views put forward in these volumes.

A Select Bibliography of Chemistry, 1492–1902. By H. C. Bolton. Second supplement. Pp. 462. (Washington: Smithsonian Institution, 1904.)

THE present volume of the "Select Bibliography" is the second supplement which has been published since the first issue in 1893, and carries the work down to 1902.

One can only admire the patient labour of the author, now unfortunately removed by death, who has placed in the hands of chemists all over the world a book of reference of such permanent value.

The supplement contains the titles of books published between 1898 and 1902 inclusive, in which the same subdivisions are preserved as in the first volume. It is just a question whether the last subdivision—academic dissertations—which fills nearly half the book, is worth the trouble it has entailed. It consists almost entirely of the titles of dissertations for the German doctorate, which in Germany often find their way into booksellers' hands, but are merely reprints of memoirs that have appeared in the scientific journals. The list is necessarily incomplete, and the trouble of indexing it must have been enormous. The proof-reading, as well as the preparation of the index, have been done by Mr. Axel Moth, of the New York Public Library. J. B. C.

Hints on Collecting and Preserving Plants. By S. Guiton. Pp. ii+55. (London: West, Newman and Co., 1905.) Price 1*s.*

THE collector of plants, whether he is merely pursuing a hobby or whether his object is to acquire specimens for reference which will enable him to get a better knowledge of systematic botany, ought to be acquainted with the best methods of preparing and arranging a herbarium. For information he will find this small book useful. Some of the suggested details are not absolutely necessary, but a little experience will soon show which are essential. In some respects Mr. Guiton tends to what one may call the collector's views, as, for instance, when he recommends gumming the specimens on cardboard; the more usual practice of fixing them by means of gummed slips on drawing paper is cheaper, and allows the specimens to be taken off for examination. The preference of iron grids in place of wooden ventilators, the advantages of cotton mattresses, and other such details which might be suggested are rather matters of individual taste; so long as a collector takes as much care as Mr. Guiton, his herbarium will be a pleasure, not only to himself, but also to kindred botanists.

Practical Retouching. By Drinkwater Butt. Pp. xv+78. (London: Iliffe and Sons, Ltd., 1904.) Price 1*s.* net

THIS book forms No. 10 of the *Photography* Bookshelf Series, and will be found a useful addition. The matter contained in it originally appeared in the pages of *Photography* in 1901, but the author has brought the information up to date and presented it in the present form, which will be found convenient for beginners. The chapters are eight in all, and after the preliminary ones dealing with things to be done and to be avoided, and the apparatus and material required for the work, we have those on general manipulations, manipulations in detail of portrait work and inanimate objects, concluding with the use of the back of the negative for further hand-work.

Stories from Natural History. By Richard Wagner. Translated from the German by G. S. Pp. viii+177. (London: Macmillan and Co., Ltd., 1904.) Price 1*s.* 6*d.*

THESE interesting stories dealing with subjects of natural history are presented in excellent English. The translator's style is graceful, and the language chosen is of a kind which will appeal to children; while the scientific information is sound as well as instructive. A young reader should learn incidentally a great deal about animal life, and at the same time be given sympathetic interest in it. The little volume is suitable for a reading book in the higher standards of the elementary school and for the lowest forms of a secondary school.

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.]*

Compulsory Greek at Cambridge.

My own experiences are somewhat different from those of your correspondents, but the result is the same. I commenced Greek when about thirteen; I passed the London matriculation, the entrance examination at Trinity, and the Little-go without any difficulty; and I have read the three synoptic gospels in the original, several Greek plays, and a certain amount of Homer, Xenophon, and Thucydides. Now, if all the knowledge I thus acquired had been of any practical value to me in after life, I should, as a matter of ordinary common sense and worldly wisdom, have kept it up; but, finding Greek absolutely useless, my acquaintance with the language has so completely faded away that I can scarcely make out the sense of a Greek quotation in a historical or theological work.

It has often been a matter of profound regret to me that the time spent on Greek was not devoted to German, for if it had I should have been able to speak the language sufficiently well to enjoy during my whole life German society, German literature, and German places of amusement.

I have never been able to discover any educational value in a training which condemns boys to grind up pages of Greek declensions and irregular verbs. In my experience of life a youth who, after acquiring some knowledge of the grammar of a modern language, is made to read easy books on the manners, customs, and history of the country where the language is spoken (and nothing is better than a well-written novel) is far better equipped for the battle of life, and is a far more agreeable companion both intellectually and socially, than a man whose boyhood has been spent in studying musty old mythologies, which nobody troubles about nowadays except the select few who have made such subjects the hobby of their lives.

By all means let the bishops continue to require a knowledge of Greek (and also of Hebrew) on the part of candidates for orders, on the ground that these subjects ought to be considered part of the professional stock-in-trade of a clergyman; but special studies of this kind, like law in the case of barristers and solicitors, need not be commenced until a youth has decided upon the profession he intends to follow. A. B. BASSET.

January 27.

Can Birds Smell?

EXAMINATION of the Bird's brain shows that the sense of smell can be but little developed. The olfactory bulbs are small. No medullated nerve-fibres unite them with the rest of the brain. Yet in no birds are the bulbs entirely absent, so far as I am aware. The olfactory membrane of birds presents certain structural peculiarities which are difficult to interpret. The nasal chambers which it lines are not large in any bird, but in some they are sufficiently extensive to suggest that olfaction is not completely in abeyance. The fact that they are better developed in birds which seek their food in the sea (petrels, the tropic bird, &c.), in which pursuit smell can, one would suppose, be of little service, than they are in most other birds seems to indicate that they have some function other than olfaction. Perhaps they serve to warm the inspired air; although here again we are confronted with the difficulty that, in the frigate bird (Fregata), in which the nasal chambers are relatively large, the nostrils are obliterated. Air may, of course, enter the nasal chambers through the cleft palate, but such a mechanism cannot provide for the warming of the air on its passage to the lungs. The teachings of anatomy being so obscure, it seemed to me desirable that direct observations should be made.

A study of the habits of flesh-eating birds shows that if they possess the sense of smell at all, it is not sufficiently acute to enable them to use it in finding food. All observers are agreed that when a carcase is hidden, by never so slight a screen, it is safe from the attacks of vultures and other carrion-seekers; but the most remarkable proof of the ineffectiveness of the sense (if it exist at all) is afforded by experiences which Dr. Guillemard was good enough to relate to me. Many times it has happened, he tells me, that, having shot a wildebeest or other game which was too heavy to carry home, he has disembowelled it, and has hidden the carcase in the hole of an "ant-bear." On returning with natives to carry it to camp, he has found a circle of vultures standing round the spot where the offal had been thrown, completely unaware of the carcase within a few yards of their beaks. Of observations proving the possession of the sense I know none, unless we are willing to accept as evidence the belief, which is very general among fanciers, that birds are attached to the smell of anise, and the similar belief of gamekeepers in some parts of the country that they are attracted by valerian. It is said that pigeons may be prevented from deserting the dove-cote by smearing their boxes with oil of anise. Poachers are supposed to lure hen-pheasants from a wood by anointing gate-posts with tincture of valerian.

With the view of testing the smelling powers of graminivorous birds, I placed a pair of turkeys in a pen which communicated with a large wired-in run. The pen was closed by means of a trap-door. In the run I placed, each day, two heaps of grain, right and left of the trap-door, but so far in front of it that they made with it an angle of about 50°. Various substances which give out a powerful odour were placed under one of the heaps, alternately the right and the left. The birds were lightly fed in the morning in their pen. At two o'clock the trap-door was raised, and they were admitted to the enclosure. It was curious to note that after the first few days the hen almost always came out first (in the last ten experiments this rule was broken but once), and invariably went to the heap on her right; the cock following went to the heap on the left. The cock usually tried the hen's heap after feeding for a short time from his own, but the hen never trespassed upon the preserve of the cock. In the earlier observations I placed beneath one of the heaps a slice of bread soaked with tincture of asafœtida, essence of anise, oil of lavender, or sprinkled with valerianate of zinc or powdered camphor. When the birds, plunging their beaks into the bread, took some of the tincture or essential oil into the mouth, the head was lifted up and shaken, but they immediately recommenced to peck at the grain. They were completely indifferent to the presence of camphor or valerianate of zinc. In several cases in which these substances were used, they consumed the bread. As a turkey does not steady the thing at which it is pecking, with its foot, but, seizing it in the beak, shakes it violently until a piece is detached, it is probable that most of the powder was shaken from the bread. As these experiments gave absolutely negative results, the birds showing neither preference for nor repugnance to any of the odorous substances used, I proceeded to stronger measures. The grain was placed upon a seven-inch cook's sieve, inverted. The odorous substance was placed beneath the sieve. Each of the following experiments was repeated three times, first with a small quantity of "smell," then with a great deal, and lastly with as much as possible. It is only necessary to describe the final tests. Four ounces of carbide was thrown into a saucer of water and placed beneath one of the sieves. There was no reason to think that the birds were aware of the existence of the acetylene which was evolved. The saucer was filled with bisulphide of carbon. The hen turkey finished her meal. When the grain was exhausted she knocked the sieve over with her foot. Both birds then lowered their beaks to within half an inch of the colourless liquid, which they appeared to examine. It is, perhaps, unfortunate that they had already satisfied their thirst at the water-trough. A bath sponge soaked in chloroform was placed under the sieve, the wire of which rested upon it. The hen finished her meal without leaving the sieve. Towards the end she

pecked very slowly, and frequently raised her head and stretched her wings as if partially narcotised. This experiment was repeated on the cock, but I could not detect any indications of narcosis. The saucer was filled with hot dilute sulphuric acid, into which an ounce of powdered cyanide of potassium was thrown. The evolution of prussic acid was so violent that I considered the neighbourhood unsafe. My gardener, who was working thirty yards away, spoke to me of the "smell of almonds." For some minutes the cock turkey fed with his usual eagerness; then, suddenly, he began to stagger round the enclosure, crossing his legs and holding his beak straight up in the air. He made his way back into the pen, where he stood with head down and wings outstretched. After ten minutes he returned to the enclosure, but did not eat any more grain. His comb and wattles were deeply suffused with blood.

In all observations on the sense of smell of animals we have an obvious difficulty to face. There is no reason for supposing that an animal enjoys an odour which pleases us or dislikes one which we find disagreeable. My dog appeared to be almost indifferent to bisulphide of carbon. He showed, however, great repugnance to chloroform and prussic acid. It is difficult to think that an animal which is unable to protect itself from the injurious effects of such drugs as these can possess the sense of smell.

I shall be very grateful to any of your readers who will give me information on this subject. Especially should I be glad to learn something about the habits of wingless birds, the mode of life of which, more or less, resembles that of a terrestrial mammal. In them, if in any birds, it would seem likely that the sense of smell would be efficient. In his memoir on the Apteryx, Owen stated that "the relative extent and complexity of the turbinated bones and the capacity of the posterior part of the nasal cavity exceed those of any other bird; and the sense of smell must be proportionately acute and important in its economy."

Downing College Lodge, January 26. ALEX. HILL.

The Origin of Radium.

IN the issue of NATURE for January 26, Mr. Soddy describes the present position of his experiments on the production of radium from compounds of uranium, and announces a positive result.

Since I wrote on May 5, 1904, pointing out that, on the theory of Rutherford and Soddy, the quantity of radium developed by a few hundred grams of uranium should be measurable in a few months, a quantity of about 400 grams of uranium nitrate has been preserved in my laboratory.

I am not yet prepared to give definite quantitative results, but Mr. Soddy's announcement may perhaps excuse a preliminary statement that the quantity of radium emanation now evolved by my uranium salt is distinctly and appreciably greater than at first.

A rough calculation of the rate of growth of radium indicates a rate of change far slower than that suggested by the simplest theory of the process, but somewhat quicker than that given by Mr. Soddy, who finds that about 2×10^{-12} of the uranium is transformed per annum. As Mr. Soddy says, it is possible that the total amount of emanation is not secured, and the fraction obtained may depend to some extent on the particular method used by each experimenter. But another possibility should be borne in mind. If a non-radio-active product, intermediate between uranium and radium, exists, the rate of appearance of radium would be slower at first, and quicker as the experiment proceeds. My uranium salt was not purified so successfully as that used by Mr. Soddy, and, when the first measurement was made a month or so after preparation, the yield of radium emanation was appreciable. It may be that Mr. Soddy is tracing the process from its inception, and that I have started at a later stage, where the rate of formation is somewhat greater. Further observation may be expected to elucidate these and other questions. W. C. D. WHETHAM.

Cambridge, January 30.

Fact in Sociology.

I ADDRESSED a letter to the editor of NATURE replying to what I allege to be misrepresentations and misstatements in a review of three of my books by "F. W. H." (December 29, 1904, p. 193). After a delay of some weeks due to the absence of "F. W. H." abroad, the editor of NATURE has written to ask me to modify and shorten my protest.

"F. W. H." told the readers of NATURE that my "Food of the Gods" "claimed to forecast the future." This was untrue, and I said so.

"F. W. H." mixed up my discussion of probabilities in "Anticipations" with my general review of educational influences in "Mankind in the Making," and presented this as my ideals. I pointed out that this was an unsound method of criticism.

"F. W. H." presented the following as my opinions:—"Germany will be cowed by the combined English and American Navies, and Anglo-Saxonism will eventually triumph. There remain the Yellow Races. Their star, too, will pale before that of the Anglo-Saxons." I repudiated this balderdash with some asperity. It is violently unlike my views.

He wrote of me, "he seems unaware of the part in the national life that is played by the lower stratum of society, the 'stagnant' masses as he would call them." I denied that I should, and pointed out that no one does know what part is played by any stratum of society in national reproduction. It is a field of unrecorded facts. I commented on "F. W. H.'s" assumption that he was in possession of special knowledge.

He wrote of "the fact that this stratum is an absolute necessity." This is *not* a fact. It may or may not be true. I commented on this use of the word "fact" in view of "F. W. H.'s" professorial sneer at my "imagination unclogged by knowledge."

He declared that I want to "get rid of the reckless classes, and depend solely on the careful classes," a statement which has not an atom of justification. He not only "guys" my suggestions, but foists an absolutely uncongenial phraseology upon me.

Finally, he wrote, "we are to introduce careful parentage, *that is*, put a stop to natural selection." I quoted this in view of his statement that I had "no very thorough grasp of the principles of evolution." I discussed what appeared to be his ideas about evolution. They appeared to me to be crude and dull, and I regret I cannot condense my criticisms to my present limits.

I expressed some irritation at his method of misstatement followed by reply, and hinted a doubt whether my own style of inquiry—in spite of the fact that romances blacken my reputation—was not really more scientific than his. H. G. WELLS.

The Fertilisation of Jasminum nudiflorum.

THIS well known plant, in accordance with its usual habit, has been flowering in my garden at Stonehaven, Kincardineshire, since the third week in December, 1904, and amidst frost and snow and cold winds. There are no leaves, but there are thousands of bright yellow flowers. It is a puzzle to me how fertilisation is effected. The two stamens are situated about half-way down the tube of the corolla, and about four or five millimetres below the style, which is, in many cases, two millimetres longer than the tube of the corolla. It seems to me to be a plant requiring the aid of insects in its fertilisation, but there are no insects to be seen at this time of the year. On January 22, as there was some sunshine, I watched the plant for about four hours, but no insect paid it a visit. At the same time I found the oblong anthers had split and pollen grains were sticking to the stigma in many flowers. The brilliantly coloured flowers, although destitute of scent, are fitted to attract insects, and the form of the flower seems adapted for their visits. But there are no insects! Can anyone offer an explanation? The plant is beautifully figured in the *Botanical Magazine*, lxxviii., tab. 4649. JOHN G. MCKENDRICK.

University of Glasgow, January 24.

The Moon and the Barometer.

It is an old popular belief that weather tends to be more settled about full moon. Here are some sayings from Inward's "Weather Lore":—

"The three days of the change of the moon from the way to the wane we get no rain" (United States).

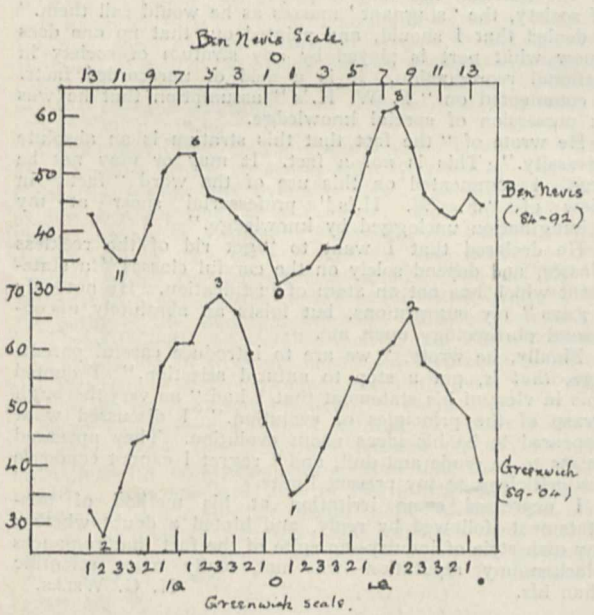
"The weather is generally clearer at the full than at the other ages of the moon" (Bacon).

"In Western Kansas it is said that when the moon is near full it never storms."

"The full moon brings fine weather." "The full moon eats clouds." (This disappearance of cloud Mr. G. F. Chambers pronounces "a thoroughly well authenticated fact.")

The following evidence in this connection seems to me instructive. It relates to Ben Nevis (1884–1892, nine years) and Greenwich (1889–1904, sixteen years), and to the summer half only (to be more exact, the six lunations commencing with that which had full moon in April).

The method was as follows:—In the case of Ben Nevis, fourteen columns were arranged for the fourteen days ending with full moon, and fourteen for those following full moon. Each day with barometer under 25·2 was represented by a dot in those (graduated) columns; total 407. The dots in each column were then counted, and the sums obtained were added in groups of three (first to third, second to fourth, third to fifth, and so on). Thus we get the upper curve in the diagram.



In the case of Greenwich, the method was slightly different (see lower horizontal scale). The columns were for seven days about each of the four phases. For comparison with the Ben Nevis curve we commence with the first day after new moon. The days here considered were those with barometer under 29·6 inches; total, 476.

These two curves seem to tell much the same tale; *few* days of low barometer about (just after) full and new moon, *many* such days about (just after) the quarters. Thus, so far as the summer half in those twenty-one years is concerned, the popular belief would appear to be vindicated.

To give a fuller idea of the relations, I add a table of the maximum and minimum values (each number is, of course, the sum of three):—

	First min.	First max.	Second min.	Second max.
Ben Nevis	35 ...	53 ...	31 ...	61
Greenwich	28 ...	69 ...	35 ...	65

It will be seen that the chief maximum is about double the chief minimum in one case, and more than double in the other.

In a dot-diagram, where each day is represented separately according to its barometer (not merely grouped with others as below a certain limit), the contrast between the phases comes out still more clearly.

The view here given apparently finds support from various quarters. In the *Meteorologische Zeitschrift* for 1900, p. 421, Herr Börnstein gives a curve of pressure for Berlin (May to August in 1883–1900) which is of similar type to those in the diagram. Fr. Dechevrens informs me that the results above given agree with those of his own observations in China, Constantinople, and Jersey. M. Sainte Claire-Deville found the same variation at Cayenne, in French Guiana.

With regard to the winter half (October to March), the *régime* would appear to be somewhat different, but I cannot speak definitely of it at present.

Whether the facts presented be thought to indicate lunar influence or not, it may be of interest to watch future weather (in the summer half) from the point of view suggested.

ALEX. B. MACDOWALL.

Reversal in Influence Machines.

The method suggested for producing reversal on a Voss or Wimshurst will not be found always trustworthy. Atmospheric conditions make a great difference. I have been experimenting for more than a year with the view of finding a solution of the reversal problem, and think I have succeeded in tracing the cause, which is primarily connected with dielectric strain. A Wimshurst with the dischargers beyond sparking distance, working at full speed, will often reverse if the discharge is made by suddenly connecting the terminals, but there is no certainty in producing this effect. I have recently constructed an influence machine akin to the Voss except that the replenishment is from the back of the disc. Reversal is still the stumbling block, and must occur with fixed inductors, while no plan for controlling the reversal can be relied upon. I should be happy to give any of your correspondents fuller particulars of my experiments if they will communicate with me.

CHARLES E. BENHAM.

Colchester, January 14.

Dates of Publication of Scientific Books.

May I through your columns suggest to publishers—especially of scientific and mathematical books—to give in their catalogues the dates of publication of their books? As a book often gets out of date very soon, such an addition would greatly help those who have no access to good libraries in selecting books to be purchased. I may say that this is done almost invariably in the catalogues of French and German publishers. To take an instance, the Clarendon Press still includes Price's "Infinitesimal Calculus" in its catalogue. Now, although to one who wants to study the subject in an exhaustive manner the book is very valuable, still, to one who wishes to know the principles only, the book is, to say the least, not worth the big price asked for; and if the date of publication were mentioned in the catalogue, the purchaser would at any rate know that he was not buying an up to date book.

R. P. PARAIYPYE.

Fergusson College, Poona, India, January 1.

Super-cooled Rain Drops.

The letter which appeared in your last issue (p. 295) from Mr. Robinson with reference to this interesting phenomenon reminds me of a similar case which I observed in Bournemouth during the winter of 1888, and I described in NATURE at the time under the title, "Is Hail thus Formed?" (vol. xxxvii., p. 295).

CECIL CARUS-WILSON.

PARA RUBBER.[1]

IN recent years the cultivation of rubber-yielding trees has attracted an increasing amount of notice. About 12,000 acres in Ceylon, and in the Malay Peninsula a still larger area, have been stocked with the Para rubber tree, *Hevea brasiliensis*, and other species of Hevea. The cultivation has also been successful in India and South America, and experimental plots are being tested in Uganda and the Gold Coast Colony.

In tropical Africa there are thousands of square miles of land suitable for growing the Para tree. But whilst the demand for rubber has been increasing with the development of the electrical and motor industries, the number of forest trees yielding the substance has been diminishing, year by year, as a consequence of the faulty methods of "tapping" employed by the natives. Hence a stimulus has been given to the production of rubber by cultivation; and with a view of fostering the industry in West Africa, Mr. Johnson was commissioned by Government in 1902 to visit Ceylon and study the methods employed there in the management of the plantations and the preparation of the rubber. He now gives, for the benefit of persons taking up the cultivation, some of the results of the visit in the form of such practical advice as would be likely to assist them in their undertaking.

The rubber trees are raised from the seeds, which may be obtained from Ceylon or the Straits Settlements at a cost of about 6*s*. 8*d*. per thousand. When the tree has attained a girth of twenty to twenty-four inches, the latex can safely be tapped; this may be in about five to seven years from the date of planting. The yield varies greatly, depending on the soil, the age of the tree, and the method of tapping. At present no really satisfactory data are available; but from such statistics as are given it would seem that about 1 lb. to 3 lb. of dry rubber *per annum* may be the average product of each tree. In addition, the seeds yield a drying oil somewhat resembling that obtained from linseed. As regards the latex-bearing "life" of the trees, it is stated, on the authority of the director of the Botanic Gardens, Straits Settlements, that trees are known to have been tapped, off and on, during fifty years, and to be still yielding a plentiful supply of latex.

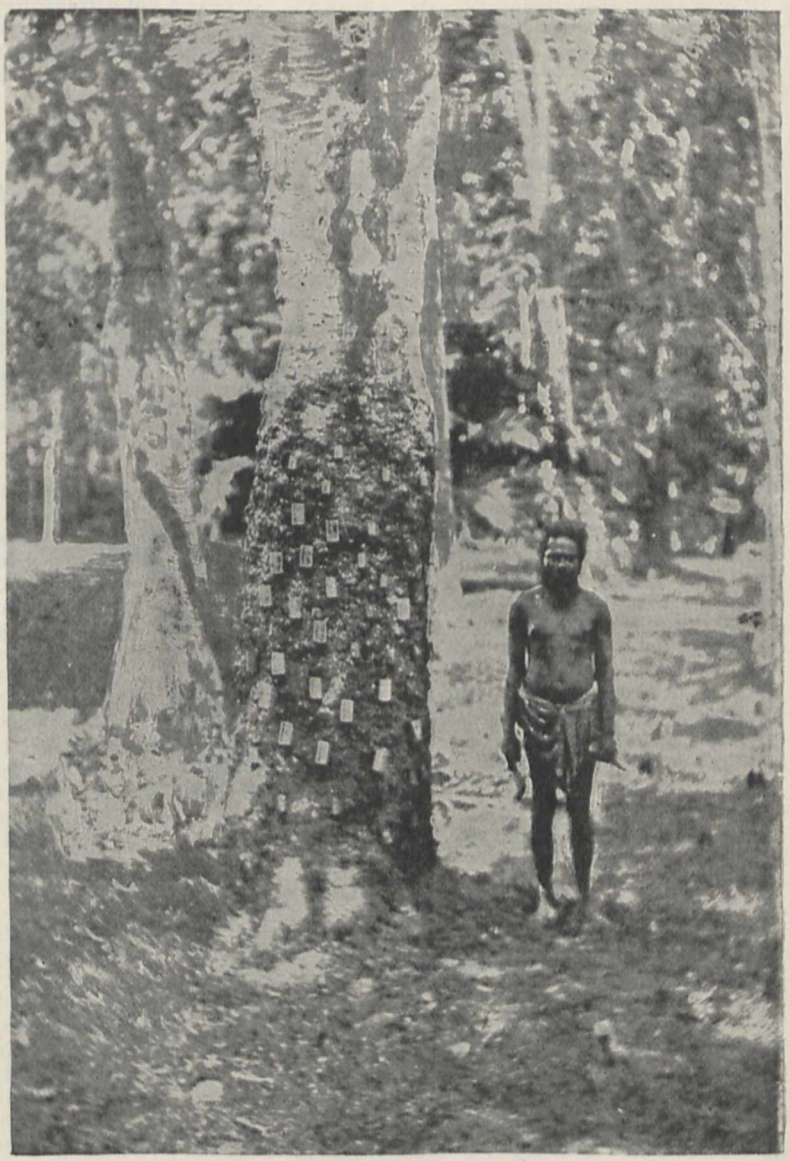


FIG. 1.—One of the Parent Trees of the Para Rubber Industry in the East, growing in the Botanic Gardens, Henaratgoda, Ceylon. (From "The Cultivation and Preparation of Para Rubber.")

The rubber-substance is contained in the latex of the plant in the form of minute globules, much as butter-fat exists in cow's milk. These globules can be made to coalesce by centrifugal action, just as cream is formed from milk in an ordinary separator; but the product thus obtained does not, apparently, compare favourably with the rubber given by the older methods of separation. These consist in coagulating the latex, either by simple exposure to the air or by the addition of an acid or a salt; the resulting coagulum is washed and rolled to free it from moisture and nitrogenous matters, and then dried by gently heating. The particular process suggested by the author is that of spontaneous coagulation of the latex in shallow saucers, followed, after washing and rolling, by exposure to the smoke of a wood fire as an antiseptic treatment. The price obtained depends largely upon the care exercised in the preparation. For example, Congo rubbers, which some time ago realised only 1*s*. to 1*s*. 6*d*. a pound, now often fetch 4*s*. in consequence of being more carefully prepared. As showing what can be done in this direction, it is interesting to note that Ceylon Para rubber has recently commanded the "record" price of 5*s*. 6*d*. per pound.

The appurtenances required are of the simplest,

[1] "The Cultivation and Preparation of Para Rubber." By W. H. Johnson. Pp. xii+99. (London: Crosby Lockwood and Son, 1904.) Price 7*s*. 6*d*. net.

and no great demand is made upon the skill of the cultivator who desires to try his fortune in this direction. As regards the call upon his capital, some idea of the cost of opening and maintaining a plantation will be obtained from the estimates which the author supplies, showing the expenditure in Ceylon and the Malay Peninsula. As an alternative to tea-planting, orange-growing, and cattle-ranching, the production of rubber would seem to be well worth consideration by young Britons who go abroad in search of a competency. C. SIMMONDS.

PREHISTORIC ENGLAND.[1]

AS this volume contains a notice by the publishers that they "will shortly begin" the issue of the series of "The Antiquary's Books," to which this belongs, it may be assumed that it is the first. For the reason that it is an earnest of the quality to be expected in its successors, the book, both in manner and matter, must be treated in somewhat more critical and judicial fashion than if the series had been already fairly launched. The responsibility of a publisher in placing an antiquarian library before the public is never light, and at the present time it suffers from the inequality of modern knowledge in respect to the various prehistoric and archæological periods. The later stages of the former class have vast floods of light thrown upon them by the constantly recurring discoveries in the Levant, and the comparative method has enabled us to classify many of our native antiquities by their means. In regard to the earlier stages of man's existence we are in the main still advancing at a painfully slow rate, and can scarcely be held to have more than a misty comprehension of the subject. In historic times the same want of balance of knowledge exists equally, though it is a far easier task to mask the difficulty, and to produce a nicely balanced tale from groups of facts of very different values.

The present volume deals only with the relics of man in Britain anterior to the coming of the Roman invaders, and in a sense, therefore, may be called prehistoric, for nothing in the nature of a native record can be quoted in support of any part of it. The author by his title, moreover, limits his field to the remains

FIG. 1.—Section of Barrow with successive Interments. From "Remains of the Prehistoric Age in England."

of the dwellers in Britain, that is to say, to the monuments they raised, the implements they made, and the graves in which they deposited their dead. The racial characteristics, as shown by the physical characters, are treated very briefly, and the burning questions of the priority of Brythons and Goidels in the land, of the precise position of the Picts as an indigenous tribe, of the succeeding immigrations from the Continent bringing with them new types of people, of weapons, or of burial customs, are only incidentally mentioned.

By the elimination of all these questions Dr. Windle has set himself an infinitely lighter task; but it is to be questioned how far an intelligent reader can gain a true understanding of the conditions described without some fuller information on these points. It must be confessed, however, that the subject bristles with difficulties of all kinds and has tempting pitfalls for even the wary searcher, and, on the other hand, Dr. Windle has a right to set his own limits. Even within these limits he may be thought somewhat hardy, for to give an adequate account of all the material relics of man in Britain from the dawn of human life up to about 2000 years ago, within the compass of little more than three hundred pages, is not a thing to be undertaken with a light heart. One of the principal difficulties to be overcome is to avoid confusion in exposition and arrangement. In this matter Dr. Windle might have had more success. In

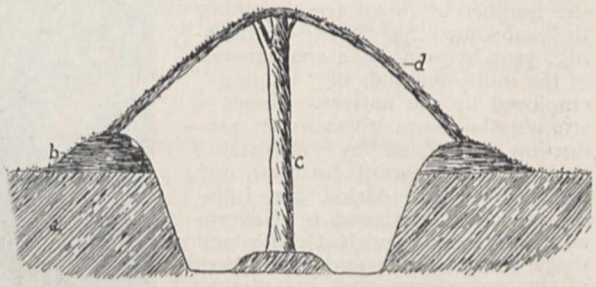


FIG. 2.—Ideal Section of Pit-dwelling. *a*, Natural soil; *b*, Bank of same heaped up around Pit; *c*, Central support of Roof; *d*, Roof of Turfs and Branches. From "Remains of the Prehistoric Age in England."

more cases than one, instances of special types of implements are quoted without giving the very necessary information that they belong to widely different periods. For instance, in dealing with "pygmy flints," a puzzling subject, Dr. Windle quotes a number of surface finds, and then goes on to say, "in France they have been discovered at Bruniquel." This can only mislead the inquirer or the student, for, so far as we know, the Bruniquel station, which is undoubtedly of the mammoth period, has no relation at all to such surface finds as have been made in Lincolnshire, Lancashire, India, or Belgium. Nothing is more certain than that mere type or form alone is the most unsafe criterion of age.

This elementary axiom may sound very like a platitude, but it is constantly neglected by men whose words carry weight, and cannot, therefore, be too much insisted upon. Such errors or vague statements affect the essentials of prehistoric science, and if persisted in inevitably retard the advance of knowledge instead of accelerating it, as Dr. Windle undoubtedly wishes to do. Again, it is very questionable wisdom to devote a chapter to "bone implements," the paragraphs dealing indiscriminately with the remains from the French caves, the Swiss lakes, and from a station like Grime's Graves. In the first place, there is again no relation between the sites quoted, and, so far as the French caves are concerned, the "bone" implements are mostly of horn. No doubt the information necessary to a proper understanding of the relative ages of the Dordogne caves, the Swiss lake dwellings, and the Norfolk flint pits is to be found elsewhere in the book; but for a popular work dealing with a difficult and complicated subject the first essential is clearness of exposition beyond all possibility of misunderstanding.

Further, Dr. Windle's authorities are occasionally antiquated. It is not treating the reader quite fairly to give him Dr. Thurnam's classification of barrows without qualification. Is it, for instance, quite certain in the light of recent knowledge that all round barrows are of the Bronze age? It is also a trifle hard to find the late Dr. Frazer quoted as an authority on

[1] "Remains of the Prehistoric Age in England." By Bertram C. A. Windle, Sc.D., F.R.S. Pp. xv + 320; illustrated. (London: Methuen and Co.) Price 7*s*. 6*d*. net.

gold in Ireland, while Salomon Reinach is not even mentioned. A little discrimination would have shown that Mr. Romilly Allen was making a curious statement (p. 293) when he said: "The bowls . . . seem to belong to the end of the Late Celtic period and the beginning of the Saxon." What becomes of the four hundred and odd years intervening between the two, when the Roman power was dominant in Britain? Such statements betray a carelessness that is not easily excused in a man of Dr. Windle's standing. The same want of precision is shown in "Hallstadt" for Halstatt, "Collie March" on one page and "Colley March" on another, the "forging" of bronze instead of "casting," and others of the same kind. In the circumstances it is a hard thing to say, but the illustrations leave much to be desired. The two figures we reproduce show diagrammatically a barrow with successive interments, and a restoration of a pit dwelling, from Mr. George Clinch's Kentish discoveries.

The book might easily have been so much better, for it has many good and useful points, that there is something exasperating in finding much to quarrel with. The index is a good and useful one, the lists of ancient remains an excellent departure, compiled with all modesty, and there is a great deal of clear treatment of some knotty questions, such as the so-called "Eolithic" period. As a series, the size of the volume is convenient and the print good, and in spite of the strictures we have felt bound to make, there is little doubt that the publishers will find a ready sale.

MEETING OF THE BRITISH ASSOCIATION IN SOUTH AFRICA.

THE British Association will hold its meeting this year in South Africa. In these exceptional circumstances, the general officers of the association requested the council to appoint a strong committee to cooperate with them in carrying out the necessary arrangements. This "South African Committee" has held frequent sittings, and its work is so far advanced that it is now possible to make the following announcements.

Although the annual circular and programme have not yet been issued, pending the receipt of information from South Africa, many members have already intimated their intention of being present at the meeting. The "official party" of guests invited by the central executive committee at Cape Town, and nominated in the first instance by the council of the association, numbers upwards of 150 persons, comprising members of the council, past and present general officers and sectional presidents, the present sectional officers, and a certain proportion of the leading members of each section. To this list has yet to be added, on the nomination of the organising committees, the names of representative foreign and colonial men of science, the total number of the official party being restricted to 200, including the local officials. It is hoped, however, that many other members of the association will also attend the meeting.

The presidents-elect of the various sections are as follows:—

A (Mathematical and Physical Science), Prof. A. R. Forsyth, F.R.S.; B (Chemistry), Mr. G. T. Beilby; C (Geology), Prof. H. A. Miers, F.R.S.; D (Zoology), Mr. G. A. Boulenger, F.R.S.; E (Geography), Admiral Sir W. J. L. Wharton, K.C.B., F.R.S.; F (Economic Science and Statistics), Rev. W. Cunningham; G (Engineering), Colonel Sir Colin Scott-Moncrieff, G.C.S.I., K.C.M.G., R.E.; H (Anthropology), Dr. A. C. Haddon, F.R.S.; I (Physiology), Colonel D. Bruce, F.R.S.; K (Botany), Mr. Harold Wager, F.R.S.; L (Educational Science), Sir Richard C. Jebb, M.P.

The vice-presidents, recorders, and secretaries of the eleven sections have also now been appointed.

In view of the numerous towns to be visited by the association, and in which lectures or addresses will be given, the number of lecturers appointed is much larger than usual. The list of these, as at present arranged, is as follows:—

Cape Town: Prof. Poulton, on Burchell's work in South Africa; and Mr. C. V. Boys, on a subject in physics. *Durban*: Mr. F. Soddy, on radio-activity. *Maritzburg*: Prof. Arnold, on compounds of steel. *Johannesburg*: Prof. Ayrton, on distribution of power; Prof. Porter, on mining; and Mr. G. W. Lamplugh, on the geology of the Victoria Falls. *Pretoria* (or possibly *Bulawayo*): Mr. Shipley, on a subject in zoology. *Bloemfontein*: Mr. Hinks, on a subject in astronomy. *Kimberley*: Sir William Crookes, on diamonds.

As the wish has been conveyed to the council from South Africa that a few competent investigators should be selected to deliver addresses dealing with local problems of which they possessed special knowledge, a geologist, a bacteriologist, and an archæologist have been invited to undertake this work, involving in two cases special missions in advance of the main party. Whilst Colonel Bruce, F.R.S., will deal with some bacteriological questions of practical importance to South Africa, Mr. G. W. Lamplugh (by the courtesy of the Board of Education) will be enabled to investigate certain features in the geology of the Victoria Falls—particularly as regards the origin and structure of the cañon—and Mr. D. R. MacIver, who is at present exploring in Nubia, will proceed in March to Rhodesia in order to examine and report on the ancient ruins at Zimbabwe and also at Inyanga.

Most of the officials, and other members of the association, will leave Southampton on July 29 by the Union Castle Mail SS. *Saxon*, and arrive at Cape Town on August 15, the opening day of the meeting; but a considerable number will start from Southampton on the previous Saturday, either by the ordinary mail-boat or by the intermediate steamer sailing on that date.

The sectional meetings will be held at Cape Town (three days) and Johannesburg (three days). Between the inaugural meeting at the former and the concluding meeting at the latter town, opportunities will be offered to members to visit the Natal battlefields and other places of interest. Subsequently a party will be made up to proceed to the Victoria Falls (Zambesi); and, should a sufficient number of members register their names, a special steamer will be chartered for the voyage home, *viâ* Beira, by the east coast route, as an alternative to the return through Cape Town by the west coast route. Thus all the colonies and Rhodesia will be visited by the association. The tour will last 70 days *viâ* Cape Town, or a week longer *viâ* Beira (all-sea), leaving Southampton on July 29 and returning thither on October 7 or 14.

A central executive committee has been constituted at Cape Town, with Sir David Gill as chairman and Dr. Gilchrist as secretary; while local committees have been formed at Johannesburg and other important centres.

Prof. G. H. Darwin, F.R.S., is the president-elect, and among the vice-presidents-elect are the following:—the Rt. Hon. Lord Milner, the Hon. Sir Walter Hely-Hutchinson, Sir Henry McCallum, the Hon. Sir Arthur Lawley, Sir H. J. Goold-Adams, Sir David Gill, and Sir Charles Metcalfe.

Sir David Gill, Mr. Theodore Reunert, and others have taken a prominent part in the initial work. The South African Association for the Advancement of Science is cordially cooperating in the local organisation, and will join with the British Association in attending the meeting.

The aim of the council has been to secure the attendance of a representative body of British men of science, including specialists in various lines of investigation, and that, along with the generous support of the people and authorities in South Africa, should go far to ensure the success of the meeting and to stimulate local scientific interest and research.

THE ROYAL COMMISSION ON COAL SUPPLIES.

THE Royal Commission appointed on December 28, 1901, to inquire into the extent and available resources of the coalfields of the United Kingdom has issued its final report, which, in 38 pages, contains an able summary of the vast amount of valuable information submitted by the numerous witnesses examined. The Commission originally appointed consisted of Lord Allerton, Sir W. T. Lewis, Sir Lindsay Wood, Sir C. Le Neve Foster, and Messrs. T. Bell, W. Brace, A. C. Briggs, H. B. Dixon, J. S. Dixon, E. Hull, C. Lapworth, J. P. Maclay, A. Sopwith, J. J. H. Teall, and R. Young. Mr. A. Strahan was subsequently added to the Commission; Sir C. Le Neve Foster and Mr. Ralph Young died before the inquiry was completed.

On the whole the report is of a reassuring character. Adopting 4000 feet as the limit of practicable depth in working, and one foot as the minimum workable thickness, the commissioners estimate the available quantity of coal in the proved coalfields of the United Kingdom to be 100,914,668,167 tons, as compared with the 90,207,285,398 tons estimated by the Coal Commission of 1871, notwithstanding the fact that 5,694,928,507 tons have been raised in the meantime. The excess is accounted for by the more accurate knowledge of the coal-seams. It is also estimated that there are 39,483 million tons of coal in the concealed and unproved coalfields.

It is thought that in future thin seams will be worked more extensively than at present, and that the use of coal-cutting machines will facilitate this. The amount of unavoidable loss incident to coal-mining is a serious factor in estimating the available resources. Much coal is lost by leaving unnecessary barriers between properties, and a certain amount must necessarily remain in order to support the surface. The amount thus left might perhaps be reduced by the introduction of the methods employed on the Continent and in America of packing excavations with water-borne sand or other materials. The recovery of coal formerly abandoned might be facilitated by the establishment of central pumping stations.

The possible economies to which attention is directed comprise the adoption of coal-cutting machines, of which 483 were in use in 1902 and 643 in 1903, and the use of electricity for the transmission of power. The importance of cleaning, sizing, and sorting coal is also strongly urged, and the extended adoption of coking advocated. In this connection the advantages of by-product coke ovens are pointed out, and it is shown that washing and compression render it possible to coke many coals previously considered worthless. It is probable that briquettes will in future be more largely used for steam and domestic purposes, and there appears to be a promising field for research for the discovery of a less smoky and less costly binding material than pitch, which is now chiefly used.

In view of the dearth of statistics of coal consumption, the following estimate for 1903 is of special interest:—

	Tons
Railways	13,000,000
Coasting Steamers...	2,000,000
Factories	53,000,000
Mines	18,000,000
Iron and steel industries	28,000,000
Other metals and minerals	1,000,000
Brick works and potteries, glass works and chemical works	5,000,000
Gas works	15,000,000
Domestic	32,000,000
Total ...	167,000,000

It is calculated by Mr. Beilby that in this total there is a possible saving of 40 to 60 million tons. More particularly in connection with the raising of steam there are immense economies capable of realisation. Economy in the production of power may be effected by the combustion of gas obtained as a by-product. Information submitted by Mr. Bennett Brough points to increasing opportunities of utilising blast-furnace waste gases as a source of power Waste gases from coke ovens might similarly be utilised. Gas engines are referred to as the most economical of heat motors, but increased efficiency both thermally and mechanically is still possible. The importance of the development of producer-gas plants is strongly urged as rendering possible the utilisation of inferior coal. Interesting information is given regarding various other ways in which economies in consumption may be effected. Regret is expressed that the recommendations of the Mining Royalties Commission of 1893 and of the Departmental Committee of the Home Office in 1895 regarding mineral statistics had not been carried out. The commissioners recommend that accurate information on the coal industry should be published by one authority, and they think that it would be of great advantage if particulars of deep borings could be preserved in a Government office.

The report must necessarily attract great attention from mining engineers and economists; and it should also be carefully studied by students in mining classes. It is essentially a cautious document; and the general public will doubtless be disappointed that Lord Allerton and his colleagues have made no sensational prophecies as to the probable duration of our coal supplies, and have given no indication as to the way in which their estimate of the available tonnage of coal compares with that of other countries. Their report certainly shows that, while the coal resources are ample, the cost of coal is not likely to decrease, as the improved methods and appliances will probably be neutralised by the increased cost of working deeper and thinner seams. Where we should be glad of clearer light from the Royal Commission is on the question of the probable condition of competing coal-producing countries when the cost of production in Great Britain is considerably raised. It is futile to offer a detailed criticism of the final report until the sections containing the reports of the district commissioners, the report of the geological committee, and the minutes of evidence and appendices are published. The probable duration of the coalfields and the colonial and foreign coal resources appear to have been dealt with in special reports written respectively by Mr. R. Price-Williams and Mr. Bennett Brough, and to these the commissioners direct attention.

NOTES.

THE Royal Meteorological Society has arranged for an exhibition of meteorological apparatus to be held on March 14–17. The exhibition will be chiefly devoted to recording instruments, but it will also include new meteorological apparatus invented or first constructed since the society's last exhibition, as well as photographs, drawings, and other objects possessing meteorological interest.

Science announces that Prof. Ernest Rutherford, of McGill University, has been appointed Silliman lecturer at Yale University for 1905. The previous Silliman lecturers have been Prof. J. J. Thomson and Prof. C. S. Sherrington.

As Prof. G. H. Bryan, F.R.S., is unable to lecture at the Royal Institution on Friday evening, March 24, Sir Oliver Lodge, F.R.S., will deliver a discourse on that date on "A Pertinacious Current."

A GRANT of 50*l.* has been awarded by the Berlin Academy of Sciences to Prof. R. Hagenbach, of Aachen, and Dr. Konen, of Bonn, for the publication of a spectrographic atlas.

THE de Candolle prize of 20*l.* for the best monograph on a genus or family of plants is offered by the Physical and Natural History Society of Geneva. Papers may be written in Latin, French, German, Italian, or English, and should be sent before January 15, 1906, to M. le Président de la Société de Physique et d'Histoire naturelle de Genève, l'Athénée, Genève (Suisse). Members of the society are not admitted to this competition.

WE are sorry to see in the *Athenaeum* the announcement of the death, on January 21, of Mr. E. Crossley, of Halifax, in his sixty-fourth year. Mr. Crossley published in 1879, in conjunction with Messrs. Gledhill and Wilson, a valuable "Handbook of Double Stars," which is complete in its information up to the time of publication. The Crossley reflector, with which excellent work is being done at the Lick Observatory, was presented to that observatory by Mr. Crossley, and contains one of the best mirrors made by the late Dr. Common.

PROF. J. W. MASON, professor of mathematics at the College of the City of New York from 1879 to 1903, died on January 10 at the age of sixty-nine years. The death is also announced of Dr. Guido Bodlaender, professor of physical chemistry and electrotechnics at the Brunswick Technical College.

WE regret to see the announcements of the deaths of Dr. T. H. Behrens, professor of microchemistry at the Delft Polytechnic School, on January 14, at the age of sixty-two; of Dr. Albert von Reinach, the eminent geologist of Frankfurt, on January 12; of Prof. Benjamin W. Frazier, professor of mineralogy and metallurgy at Lehigh University since 1871; and of M. Joseph Chaudron, the Nestor of Belgian mining engineers, at the age of eighty-two. M. Chaudron's method of boring shafts was first employed in 1848, and its most recent application is now in progress at the colliery at Dover.

THE annual general meeting of the Iron and Steel Institute will be held on May 11 and 12. The annual dinner will be held—under the presidency of Mr. R. A. Hadfield—in the Grand Hall of the Hotel Cecil on May 12. The autumn meeting will be held in Sheffield on September 25–29. Members of the institute are invited to participate in an International Congress of Mining, Metallurgy, Mechanics and Applied Geology, to be held at Liége on June 26 to July 1, in connection with the International Exhibition. The general secretary of the organising committee is M. Henri Dechamps, 16 Quai de l'Université, Liége.

DR. F. T. ROBERTS will deliver the Harveian Oration of the Royal College of Physicians of London on June 21. Dr. W. H. Hamer has been appointed to deliver the Milroy lectures on State medicine and public hygiene for 1906; the lectures for this year will be delivered by Dr. T. M. Legge on "Industrial Anthrax," on March 7, 9, and 14; Dr. W. H. Allchin will deliver the Lumleian lectures, "Some Aspects of Malnutrition," on March 28, 30, and April 4; and the second Oliver-Sharpey lecture, "The Influence of Atmospheric Pressure on Man," will be delivered by Dr. L. E. Hill on April 6. Other lectures to be delivered during the year are the Croonian, by Prof. E. H. Starling, F.R.S.; the FitzPatrick, on "The History of Medicine," by Dr. Norman Moore; and the Bradshaw lecture, by Dr. G. R. Murray.

ON Sunday, January 22, M. Victor Serrin died, at Neuilly-en-Tel, Department of Oise, aged seventy-five years. M. Serrin was the inventor of the first automatic regulator of the electric arc light used in the public service. The action is so satisfactory that the apparatus is still in use, after fifty years of scientific progress. M. Serrin produced other ingenious inventions, but no other has had the importance of his arc lamp. In 1852, M. Serrin was in charge of the rebuilding of the Pont St. Michel in Paris, and, as the work was urgent, men were kept busy night and day. At night an electric light, with hand-feed adjustment, was used, since no regulators existed. Provided with blue spectacles, Serrin watched the lamp and adjusted the carbons when necessary. He thus contracted ophthalmia, in consequence of which he nearly lost his sight. The idea of the regulator then occurred to him, and he made all the parts with his own hands. At the funeral the principal scientific societies of Paris sent wreaths.

THE Johns Hopkins Hospital *Bulletin* for January (xvi., No. 166) contains a number of papers of pathological and medical interest, together with an interesting account by Dr. Platt of Fabricius Guilhelmus Hildanus, the "father" of German surgery, who lived in the latter part of the sixteenth and beginning of the seventeenth centuries.

WE have received the January number of *Le Radium*, a monthly journal devoted to radio-activity and now commencing its second year of publication. It contains articles on Finsen's method of phototherapy, on the sensitisation of living tissues by the injection of certain fluorescent dyes whereby they become more susceptible to, and more penetrable by, the radium rays, and on the phenomena of induction, together with a comprehensive review of recent work. The publication is excellently printed and illustrated.

MESSRS. WINSLOW AND BELCHER have carried out an investigation on the variations in the number of bacteria in samples of sewage kept in the laboratory (*Journal of Infectious Diseases*, i., No. 1). They find that the total number of bacteria rises rapidly during the first twenty-four hours of storage, increasing more than ten-fold, and then decreases steadily for at least six months. The rise and fall in the number of bacteria appear to affect the various organisms in an almost equal degree, there being no tendency towards the development of a pure culture of any dominant form.

A THIRD example of variation—among gold and silver pheasants—is discussed by Mr. F. Finn in the *Avicultural Magazine* for January. These variations, in the colour and markings of the plumage, would, in the author's opinion, be regarded as at least of subspecific value if the birds were wild instead of domesticated.

IN the *Proceedings* of the Royal Physical Society of Edinburgh for December last (vol. i. part i.) Dr. Gerald Leighton discusses the variation in the matter of scaling displayed by the common viper (*Vipera berus*), which he shows to be very extensive. His main thesis is apparently to demonstrate that squamation is an unsound feature upon which to rely in the discrimination of reptilian species, and consequently that the "small red viper" of the British Isles is entitled to be regarded as a distinct form. As regards mammals and birds, at all events, modern naturalists by no means accept it as "an axiom in zoological classification that morphological characters alone are to be taken into consideration."

VARIATION of another type forms the subject of a paper by Mr. O. C. Bradley in the above-mentioned issue of the *Proceedings* of the Edinburgh Physical Society. The trapezium of the carpus of the horse is the structure discussed in this communication, and it is shown that this bone is present, either in one or both limbs, in about 50 per cent. of the skeletons examined, while if each carpus be taken separately (that is, without reference to the condition in its fellow) the percentage is a little more than 40. This, in conjunction with its minute size, leads to the conclusion that in the evolution of the monodactyle foot of the horse the bone in question is following in the steps of the lateral metacarpal with which it was originally connected.

THE article on Dr. True's recent memoir on "The Whalebone Whales of the Western North Atlantic" which appeared in NATURE of November 14, 1904 (p. 84), has led Mr. F. A. Lucas, of the Brooklyn Institute Museum, to send us some results of measurements of whales made by him at Balena, Newfoundland. Mr. Lucas was one of the party sent to Newfoundland by the U.S. National Museum in 1903 to secure the skeleton and mould of a large sulphur-bottom whale in order that the skeleton and a reproduction of the whale might be prepared for the St. Louis Exposition. If whales grow slowly and require many years to reach their full size, there should naturally be examples of all sizes from small to large among those measured. As a matter of fact, Mr. Lucas remarks that, with the single exception of a female 64ft. long, all the sulphur-bottom whales examined by him were fairly large, and while some were immature and some old, the difference between the largest and smallest was, for such large animals, inconsiderable. With the exception noted the females, ten in number, varied from 68ft. 10in. to 75ft., the greatest jump being from 71ft. 8in. to 74ft. 4in. Fourteen males varied from 67ft. 7in. to 74ft. 8in., the greatest break being at the commencement of the series, from 67ft. 7in. to 68ft. 11in. No very small sulphur-bottom whale was taken during Mr. Lucas's stay, but several young humpbacks were brought in from 24ft. to 26ft. in length. These were still nursing, and it seems fair to assume that a sulphur-bottom whale of the same age (a yearling?) would be from 30ft. to 35ft. long. This seems to indicate that young sulphur-bottoms keep away from the coast of Newfoundland, while the fact that the 64ft. specimen was much younger than those 67ft. to 69ft. long would indicate that up to this point at least whales grow with great rapidity. As to the size of adult whales, Mr. Lucas remarks that, neglecting the wild statements of sailors and others, the length of the sulphur-bottom, *Balaenoptera musculus*, is given as being from 85ft. to 95ft. No whales so large as this were taken during the season of 1903. The largest four females ranged from 74ft. 4in. to 75ft. long, the largest three males 73ft. 4in. to 74ft. 8in., the measure being taken from the notch of the flukes, along the body, to opposite the tip of the nose. All these whales were not merely adult, but, as shown by an examination of their vertebræ, were old, the largest male, taken for a skeleton, having the epiphysial sutures obliterated save for a line or two on the thoracic vertebræ. Mr. Lucas consequently considers that it seems fair to assume that the average length of a fully grown sulphur-bottom is just under 80ft.

CONTINUING their notes on the Codiaceæ in the *Journal of Botany* (January), Mr. and Mrs. Gepp describe with figures a new species and a new variety of the incrusted alga Penicillus, also a new form of *Rhipocephalus Phoenix*, which were collected by Mr. M. A. Howe off the Bahamas. Mr. G. C. Druce publishes in the same journal a long list of flowering plants and ferns for which new localities in Berkshire have been recorded since the "Flora of Berkshire" was issued, and Mr. C. E. Salmon discusses *Limonium vulgare* and its varieties.

A LIST of the species of Compositæ from the Island of Formosa which are represented in the herbarium of Tokio University forms the concluding part of vol. xviii. of the *Journal* of the College of Science, Tokio. The author, Mr. B. Hayate, prefaces his list with an analysis of the genera, thirty-nine in number. Among these Blumea furnishes seven species, including, of course, *Blumea balsamifera*, the source of Ngai-camphor. Two new species, a Gynura and a Eupatorium, are described and figured.

THE limit of an Antarctic phytogeographical zone is discussed by Mr. C. Skottsberg, the botanist of the Swedish Antarctic Expedition, 1901–3, in an article in the *Geographical Journal* (December, 1904). It has been usual to include in the Antarctic flora the plants of Tierra del Fuego and the Falkland Islands, but Mr. Skottsberg prefers to confine the term Antarctic to a cold desert zone which comprises Graham Land and the islands lying north of it, also the South Shetlands and the South Orkneys, and to distinguish another, the Austral zone, in which the climate permits of the formation of forest or grassland. The two zones differ also with regard to their algal vegetation; the Austral flora contains algæ with floating fronds such as *Macrocystis pyrifera* and *Durvillea utilis*, but these are wanting in the Antarctic zone, where calcareous algæ predominate.

AN interesting summary of the rainfall of the British Isles for the year 1904 is given by Dr. H. R. Mill in *Symons's Meteorological Magazine* for January. Taking the British Isles as a whole, the year may be considered as a moderately dry one; the deficiency in the amount of rainfall does not seem to have exceeded 8 per cent.; the extremes noted were 129.3 inches at Seathwaite, and 16.1 inches at Shoeburyness. The whole of the Atlantic border from Cornwall to Shetland had more than the average amount; the excess was most marked in the west of Ireland, being as much as 18 per cent. in places, but the east of Ireland was so dry that the whole island exceeded the average by only 1 per cent. In England and Wales there was a deficiency of about 12 per cent. The driest region

occupied the midlands and extended to the Severn on the south-west, the Humber on the north-east, and Yarmouth on the east. The whole of this area had a deficiency exceeding 20 per cent. For the whole of Scotland there was a deficiency of about 8 per cent.; this was due mainly to the exceptional dryness of the east coast. Dr. Mill loses no opportunity of enhancing the value of his published rainfall tables, and we are glad to learn that all values quoted in future will be referred to an average of thirty years, 1870–99.

PARTS xi. and xii. of vol. ciii. of the *Bulletin de la Société d'Encouragement* contain a review, by M. L. Gruner, of the metallurgical exhibits at the St. Louis Exhibition, and a general account, by M. H. Le Chatelier, of the uses of special steels in industry.

THE report for 1904 of the Board of Trade on its proceedings under the Weights and Measures Act contains particulars of a new denomination of Board of Trade standard of 50 pounds weight which has been made and verified in consequence of representations by the Liverpool Chamber of Commerce and the Mersey Docks and Harbour Board. The use in trade of this denomination of weight was authorised by an Order in Council of October 9, 1903. During the past year a number of "Board of Trade" standards, the accuracy of which is required by law to be re-determined once in each five years, have been verified in relation to the imperial and metric standards.

ALTHOUGH several investigations have been made during the past six years on the deviation of the kathode rays in an electric field, the true nature of the deviation has not yet been satisfactorily determined. In vol. xxxv. of the *Sitzungsberichte* of the Physico-medical Society of Erlangen, Mr. F. Schneider describes experiments from which, by excluding disturbing factors, he is able to decide that the deviation is of a purely electrostatic nature, and that the dark kathode space has no influence upon it. Variations in the deviation caused by differences of potential and by other circumstances were carefully measured. The same volume of the *Sitzungsberichte* also contains a discussion, by Dr. A. Wehnelt, of the production of negative ions by incandescent metallic oxides, and an interesting account, by Dr. Ferdinand Henrich, of Liebig's life as a student at Erlangen and Paris.

IN the December (1904) part of the *Bulletin de la Société d'Encouragement* (vol. ciii.), M. H. Le Chatelier criticises the method recently introduced by Mr. Gayley at the Carnegie Steel Works of using in the blast furnaces a current of air which has been freed from moisture by cooling it below 0° C. by means of an ammonia freezing machine. It is contended that Mr. Gayley's paper, recently read before the Iron and Steel Institute, contains statements which make it improbable that the alleged economy of 20 per cent. in the fuel used in this process is due solely to the mere desiccation of the air. The principal advantage of drying the air for the blast probably lies in its giving rise to a cast containing less sulphur than ordinary pig-iron, owing to the diminished formation in the absence of water of hydrogen sulphide capable of attacking the spongy iron. Preliminary experiments have shown the probability of this view.

WE have received from the firm of Ferdinand Ernecke, of Berlin, a catalogue of their lanterns for optical projection; this catalogue is noteworthy because of the description which it contains of methods for demonstrating by projection many optical phenomena, such as interference, diffraction, and the behaviour in polarised light of crystalline sections. Messrs. Ernecke, we notice, have acquired the sole right of manufacturing the various forms of the Wehnelt interrupter.

IN the course of an investigation on the anomalous dispersion of sodium vapour, Prof. R. W. Wood (*Proc. Amer. Acad.*, 1904, xl., 365) has observed that the vapour of sodium possesses a most remarkable viscosity which makes it possible to obtain at one part of an exhausted glass tube a mass of the heated vapour of great density separated by a high vacuum from the glass plates which close the ends of the tube. The tendency of the metal to distil into the colder parts of the tube is extraordinarily small; even after an hour hardly a trace of sodium vapour can be detected beyond the heated portion. The vapour appears to possess a cohesion similar to that of a liquid, and even in a vacuum tube it seems to have a free surface. Potassium, on the other hand, distils instantaneously into the colder parts of the tube. The dispersion of sodium vapour in the vicinity of the D_3-line of helium is almost incredibly great; if a prism could be constructed of sodium vapour giving the same deviation as a glass prism of 60°, two lines in the spectrum, separated by a distance equal to one twenty-third of that between the D-lines, would appear separated by a distance greater than that between the red and bluish-green of the spectrum formed by the glass prism. But even this dispersion is small compared with that which obtains within, say, one Ångstrom unit of one of the D-lines of sodium. The variation of the index of refraction with wave-length is shown to conform throughout the range λ 2260–7500, except very close to the D-lines, with the simplest form of the dispersion formula developed from electromagnetic considerations for a medium with a single absorption band.

MM. H. MOISSAN AND CHAVANNE have taken advantage of the production of metallic calcium on a commercial scale to re-determine some of its physical properties. The specimens which they had under examination contained from 99.3 to 99.6 per cent. of the metal, and were only acted upon slowly by water. Calcium can be easily turned into cylinders possessing a brilliant lustre, tarnishing, however, as might be expected, in moist air. It is sufficiently tenacious to be drawn into wire as fine as 0.5mm. diameter, and these wires were utilised for the determination of the specific electrical conductivity, this proving to be about 16 per cent. of that of silver. The melting point was found to be 810° C. and the density 1.548. The metal was also utilised to prepare calcium amalgam in quantity; this is stable in dry air at the ordinary temperature, and does not absorb either nitrogen or oxygen. The crystalline amalgam corresponds very nearly to the compound Hg_8Ca. It is interesting to note that, whilst in a recent list of Kahlbaum metallic calcium is quoted at 6*s.* 1*d.* for 15 grains, or about 9*l.* per oz., since its manufacture on an industrial scale it can be obtained at 1*s.* 6*d.* per oz.

THE January part of *L'Enseignement mathématique* contains a number of papers which should prove of interest to English mathematicians. Dr. J. S. Mackay, of Edinburgh, contributes an interesting account of the life and works of the late Prof. Tait. Prof. Gino Loria gives an account of the progress made and the methods adopted in Italy in the reform of teaching of elementary mathematics, and in particular geometry. Mathematical teaching for engineers forms the subject of a paper by Prof. Jules

Andrade, based on his own experiences in the University of Besançon, and finally, M. Louis Couturat, of Paris, contributes a paper on "The Definitions of Mathematics."

A SERIES of articles by Mr. E. Edser on the "Electromagnetic Theory" is appearing month by month in *Technics*, and should prove useful to students of physics. The article contributed to the January issue deals with the electric circuit. A very simple method is given of determining the force on a conductor carrying an electric current perpendicular to a magnetic field, and this result is used to obtain an expression for the electromotive force produced when a conductor cuts lines of force. The results, of course, are well known, and are used by every electrical engineer, but the reasoning by which they are obtained is not so widely understood. Most of the results are determined directly from the properties of lines of force, and the usefulness of the article is greatly increased by careful scale drawings.

MESSRS. R. AND J. BECK, LTD., supply, for one guinea, a glass trough, 4×3×0.8 inches, which can be raised or depressed on a vertical metal upright a distance of from 1½ inches to 10 inches from the table. This trough forms a simple form of light filter when filled with liquid, and will serve not only as a useful adjunct to a microscope, but for many other purposes where it is of advantage to use a screen for monochromatic light.

MESSRS. TAYLOR, TAYLOR AND HOBSON, LTD., have recently issued two series of rapid Cooke lenses that should prove of great service, not only in high-speed photography, but for the finest portraiture and for difficult subjects under fair conditions of lighting. They are known as the Series iv. and ii., and have full apertures of *f*/5.6 and *f*/4.5 respectively. The makers have fully developed in these new lenses the advantages of construction of their well-known Series iii. and v. Cooke lenses. The leaflet, which contains details and prices of these lenses, includes some striking illustrations of the work accomplished by them.

WE have received from Messrs. Burroughs Wellcome and Co. their photographic exposure record and diary, which is a most handy pocket book and contains many new features. The monthly light tables are now placed at the end of the book, and the order of the months has been reversed so that the current month faces the exposure calculator, each month being torn off as it passes. This renders the calculation of an exposure a very simple process indeed. There is also ample room for recording details of plates exposed, facts relating to positive exposures, and ordinary notes and memoranda, for each of which three separate sets of pages are available. In addition to these and other items of useful information for photographers, there is a serviceable article on exposure, giving complete instructions for using the calculator provided, a concise explanation of the factors governing correct exposure, and an up to date list of the speeds of all plates and films, including, besides British, a number of American and Continental brands. Bound in a neat cover, with pocket and pencil attached, this excellent, cheap, and compact little pocket encyclopædia of photography should be in great demand by all workers, whether amateur or professional.

MR. W. B. CLIVE has published new and enlarged editions of parts i. and ii. of Dr. G. H. Bailey's "Tutorial Chemistry." Both volumes have been edited by Dr. William Briggs.

THE Engineering Standards Committee has now issued its report on pipe flanges. It is entitled "British Standard Tables of Pipe Flanges," and is published by Messrs. Crosby Lockwood and Son at 2*s*. 6*d*. net.

THE Department of Revenue and Agriculture of the Government of India has published the agricultural statistics of India for the years 1898–9 to 1902–3, in two volumes. The first part is concerned with British India and the second with the native States. The voluminous particulars have been compiled under the supervision of the director-general of statistics.

SEVERAL catalogues of physical, chemical, and other scientific apparatus have been received from Messrs. Brady and Martin, Ltd., of Newcastle-upon-Tyne. Among interesting instruments described in a supplement that brings a larger catalogue up to date may be mentioned Sodeau's new form of gas analysis apparatus, and Seger's cones for the determination of the temperature of furnaces, kilns, &c. A special supplementary list of new apparatus for experiments in physics includes particulars of simple appliances described in recent text-books of practical physics which are largely used in the laboratories of schools and colleges.

THE story of the Zeiss works at Jena is of deep interest, both in its scientific and sociological aspects. Prof. F. Auerbach described the Jena enterprise in a volume published in 1903. This work has now been translated into English by Mr. S. F. Paul and Mr. F. J. Cheshire, and published by Messrs. Marshall, Brookes and Chalkley, Ltd., under the title "The Zeiss Works and the Carl-Zeiss Stiftung in Jena." A short account of the creation and progress of these great cooperative works was given in the obituary notice of Prof. Ernst Abbe which appeared in last week's NATURE (p. 301). Many other interesting particulars will be found in the English edition of Prof. Auerbach's book, which is a popular description of the development and importance of a concern that offers valuable lessons to students of physics, technology, and social science.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES IN FEBRUARY:—

Feb. 5. 9h. 7m. Minimum of Algol (β Persei).
8. 2h. Conjunction of the Moon and Venus. Venus 3° 20′ N.
,, 5h. 56m. Minimum of Algol (β Persei).
9. 18h. Conjunction of the Moon and Jupiter. Jupiter 2° 49′.
13. 5h. 12m. to 6h. 32m. Moon occults θ^2 Tauri (mag. 3·6).
,, 5h. 14m. to 6h. 29m. Moon occults θ^1 Tauri (mag. 3·9).
14. 12h. Venus at greatest elongation, 46° 41′ E.
,, Venus. Illuminated portion of disc=0·516, of Mars =0·903.
18. 5h. 53m. to 8h. 9m. Transit of Jupiter's Satellite III. (Ganymede).
19. Partial eclipse of the Moon, partly visible at Greenwich.
,, 4h. 41m. First contact with penumbra.
,, 5h. 34m. ,, ,, shadow.
,, 7h. 0m. Middle of the eclipse.
,, 8h. 7m. Last contact with shadow.
,, 9h. 19m. ,, ,, penumbra.
Moon rises at Greenwich at 5h. 16m.
Magnitude of the eclipse=0·410.
21. 10h. 5m. to 10h. 40m. Moon occults η Virginis (mag. 4·0).
24. Vesta 3° N. of δ Virginis.
28. 7h. 40m. Minimum of Algol (β Persei).

JUPITER'S SIXTH SATELLITE.—A further telegram respecting the recently discovered sixth satellite of Jupiter has been received from the Kiel Centralstelle. It contains a statement from Prof. Perrine that the object discovered by him is not identical with Prof. Wolf's minor planet 1905 P.V. The position of the satellite on January 17 at 8h. 44.3m. (Lick M.T.) was R.A.=1h. 21m. 8s., dec.=+7° 27′.

A later telegram than the above, published in a supplement to No. 3990 of the *Astronomische Nachrichten*, states that Prof. Perrine observed the satellite on January 17.702 (G.M.T.), and found that its position with reference to Jupiter was 266° and its distance 36′.

EPHEMERIS FOR COMET 1904 *c*.—The following is the latter part of a daily ephemeris for comet 1904 *c* (Borrelly) published by Herr M. Ebell in No. 3989 of the *Astronomische Nachrichten*.

1905	α (true) h. m. s.	δ (true) ° ′	log r	log Δ	Brightness
Feb. 1	2 9 8	+15 17	0·2092	0·1501	0·58
2	2 11 7	+15 54			
3	2 13 6	+16 31			
4	2 15 7	+17 7			
5	2 17 8	+17 43	0·2133	0·1638	0·54

Brightness at time of discovery=1.0 (=mag. 10.0).

From the above it will be seen that the comet is now travelling in a north-easterly direction through the constellation Aries, and is observable—although very faint—between sunset and midnight.

SOLAR ECLIPSE PROBLEMS.—In an address read at the International Congress of Arts and Sciences, held at St. Louis in September, Prof. Perrine enumerated and discussed a number of the outstanding problems which still confront solar eclipse observers.

The first problem mentioned was that relating to the existence of an intra-mercurial planet, and Prof. Perrine states that this year's eclipse ought to settle the problem so far as the existence of a body brighter than the tenth magnitude is concerned. Such a body would not be above 12 or 15 miles in diameter, and it would take about a million such to account for the anomalies in the motion of Mercury.

The movements and velocities of coronal matter are most important problems which should be settled, and, as stations situated so far apart as Labrador and Egypt may be utilised during the coming eclipse, this should offer an exceptional opportunity of solving the problem, because of the length of time between the passing of the shadow at these places. Prof. Perrine suggests the employment of cameras having focal lengths of 40 or 50 feet and pointed directly at the sun, or, where the atmospheric conditions are favourable, longer cameras, mounted horizontally, might be used. The rotational velocity of the corona as regards that of the sun's surface is another problem which he discusses. Finally, he points out the urgent need for a number of well-equipped and well-organised expeditions, and suggests that the interchange of plans and ideas before the eclipse takes place might lead to results of greater value being obtained.

THE CONDITIONS IN THE SOLAR ATMOSPHERE DURING 1900–1.—An interesting discussion of the conditions obtaining in the solar atmosphere during the minimum epoch of 1900–1, as indicated by the author's eclipse photographs taken in Spain and Sumatra, is given in the January number of the *Bulletin de la Société de France* by M. N. Donitch, of St. Petersburg. He discusses in turn the spectra of the chromosphere, the prominences and the corona, the form of the corona, and the solar repulsion theory of Prof. Bredichin as applied to the latter.

In discussing the spectrum of the chromosphere, he refers to Sir Norman Lockyer's eclipse results, and, in directing special attention to the lines at λλ 5317.7 and 4233.8 (Donitch), he states that his results as to the non-agreement of these with the monochromatic coronal radiations incontestably confirm the conclusions arrived at from the English observations.

The spectra obtained by M. Donitch show that the prominences may be divided into two types, one composed entirely of calcium vapours, the second containing in addition hydrogen and helium.

TRIANGULATION OF THE PLEIADES STARS.—An important addition to the data concerning the positions, the intermutual distances, and the movements of the Pleiades stars is contained in parts vi. and vii., vol. i., of the *Transactions* of the Astronomical Observatory of Yale University.

During 1884–6 the director, Dr. Elkin, made a series of heliometer observations for the triangulation of the Pleiades, and published the results in part i. of the same volume of the *Transactions*. Since then, however, a new source of systematic error affecting such results has been discovered, and Dr. Elkin has, therefore, re-reduced his observations. The final values are given in part vi., and are therein compared with the similar results obtained at Königsberg in 1840 and those obtained during the more recent triangulation carried out at Yale. The results of these comparisons indicate a motion, in regard to the rest of the group, of 9 out of the 58 stars common to the three researches; the apparent displacements determined from the comparison of the Königsberg and Yale results are shown on a chart accompanying the present paper.

Part vii. of the publication contains an account of the second triangulation carried out at Yale by Mr. Mason F. Smith during the winters of 1900–1 and 1901–2, and shows the complete reduction of the observations, together with a final table in which the places of 58 Pleiades stars, for 1885.0, are given with the precession and secular variation values for each.

A BRIGHT METEOR.—Mr. J. Ryan, writing from the Manor House, Kensal Green, N.W., states that he observed a very brilliant meteor at about 11.58 on the night of January 27. The meteor appeared about three degrees below Orionis as bright as a star of the first magnitude; it travelled slowly in a path nearly parallel to a line joining κ and β Orionis, increasing in size until it burst into a green ball when below β Orionis, and faded. The complete path was traversed in about 8 seconds.

THE GENERAL MOTION OF CLOUDS.

THE issue of the *Quarterly Journal of the Royal Meteorological Society* for October, 1904, contains a translation of the report on the international observations of clouds presented by Prof. H. H. Hildebrandsson to the Permanent International Committee during its session at Southport in 1903. It is not too much to say that this report is one of the most important contributions to our knowledge of the physics of the atmosphere which the last twenty-five years have brought forth, and the Royal Meteorological Society has rendered a substantial service by making the report accessible to English readers.

Our knowledge, from direct observations, of the average motion of the air over the greater part of the earth's surface has been in a sense complete for a considerable number of years, but of the currents in the upper air we have until recently had little or no direct information, and all schemes of a general circulation of the atmosphere as a whole have had to substitute hypothesis for fact in dealing with this part of the subject. It therefore became of the highest importance to see whether any direct evidence could be obtained on this point. The most obvious method of attacking the problem consisted in observing the direction and speed of drift of dust or water particles suspended in the atmosphere. Dust particles are seldom sufficiently numerous in the upper air to be of use in this connection, but clouds occur in all parts of the world, and their observation is comparatively easy. Even this method, however, has its limitations. Observations are clearly impossible on cloudless days, and it also frequently happens that the upper clouds are obscured by lower cloud forms.

To obtain any general results observations from every part of the earth's surface were essential, and to secure these the ponderous machinery of international cooperation had to be called into play. In the year 1878 a request was addressed to the Permanent International Committee to organise a comprehensive system of cloud observations. After some preliminary consultations a scheme, in which cloud forms were divided into two classes, viz. upper and lower clouds, was adopted, and observations on this plan

were made for several years during the 'eighties. Comparison of the results, however, showed that the adopted classification was inadequate, and it became necessary to agree on a more complete subdivision of cloud forms. This task proved to be by no means an easy one, but eventually our present international classification of clouds into ten main types was adopted, and some years later, early in 1896, the international cloud atlas, which contains twenty-eight coloured plates illustrative of cloud forms, together with explanatory text in three languages, was published.

At the request of the committee, cloud observations were carried out at a large number of stations during the period from May 1, 1896, to the end of 1897. At the more important stations the height and the direction of motion of clouds were determined by means of the photogrammeter or with theodolites; at the remainder, direction only was observed with the help of nephoscopes.

The materials thus accumulated, as well as a large number of trustworthy observations of earlier date, are discussed by Prof. Hildebrandsson in the present report. The method adopted has been to work out, for each region of the earth's surface, the direction of the average monthly drift of the atmosphere at various heights with a "resultantometer" devised by Mr. Sandström. The results are set out in tables and diagrams, and in what follows attention will be directed to some of the most important points.

I.—*Tropical Zone.*

Observations at stations near the equator agree in showing a drift of the upper atmosphere from some easterly point at all seasons of the year. At Paramaribo (Dutch Guiana, lat. 5½° N.), out of 270 observations of upper clouds, only 6 were from south-east and five from north-east. This well marked easterly current in the uppermost regions of the air near the equator was revealed in a most singular manner during the eruption of Krakatoa in 1883. The optical effects produced by the fine dust, which was carried up to great heights, travelled round the earth from east to west in about twelve or thirteen days, indicating an upper east wind moving with the prodigious velocity of 83 miles per hour.

II.—*Trade-wind Zone.*

The generally accepted theory of the origin of the trade winds formulated by Halley and completed by Hadley teaches us to expect upper anti-trade winds from south-west or north-west in the northern and southern hemispheres respectively, and this expectation was found to be fully confirmed. At Mauritius, which lies in the centre of the region over which the south-east trade wind prevails, the cloud observations show a steady upper wind from the north-west throughout the year. We may therefore assume the existence of an upper wind from the south-west at corresponding latitudes in the northern hemisphere.

As more temperate regions are approached this south-westerly wind becomes deviated to the right, and at Teneriffe, and still more decidedly at San Fernando and Lisbon, the average drift at the cirrus level is from almost due west. No support is afforded to the assumption made by James Thomson and by Ferrel in their schemes of the general circulation of the atmosphere, that the anti-trade wind continues its course as an upper south-westerly wind until the Arctic regions are reached.

Special interest attaches to the observations from the region between the upper equatorial east wind and south-westerly or north-westerly anti-trade winds. On the northern side of the equator, at surface level, a broad band on the earth's surface is alternately covered in winter by the north-east trade wind and in summer by the tropical belt of calms. At higher levels a similar alternation is shown. In winter, when the trade wind prevails at the surface, the anti-trade from south-west blows above, but in summer the tropical upper east wind is found above the calm region at the surface. The observations from square No. 39 of the Atlantic Ocean, which is situated in 10°–20° lat. N., 20°–30° long. W., form the most complete example of this alternation in Prof. Hildebrandsson's report; some further very striking instances are to be found in the cloud results for the West Indies recently published by the U.S. Weather Bureau (*Monthly Weather Review*, vol. xxxii., No. 4, p. 166).

III.—*India.*

The wind circulation over India is exceedingly complex at the surface, but at higher altitudes a much simpler state of affairs is found to prevail. Prof. Hildebrandsson divides his observations into two groups, those from the north (Lahore to Calcutta) and those from the more central districts between Bombay and Cuttack. He finds that in the former the upper currents blow steadily from the west from December to April, but during the remainder of the year they tend to become easterly. Over Central India the upper westerly wind prevails throughout the year, except in August and September. Since the appearance of the report, Sir John Eliot has dealt with the detailed cloud observations taken at six Indian stations during the years 1896–1900 (*Indian Meteorological Memoirs*, vol. xv., part i.). These show a much steadier upper westerly current in the north. At Simla and Jaipur the average upper wind is westerly throughout the year; at Lahore and Allahabad an easterly component appears in the averages for August and September only. Further to the south we find an alternation similar to that described above. At Madras the equatorial upper current from the east prevails during the summer; in winter the upper currents vary between south and south-west.

IV.—*Temperate Zone.*

Throughout the temperate zone the direction of the average upper currents is from some westerly point all the year round in both hemispheres, though few observations are available from the south of the equator. In Europe and in North America there is thus substantial agreement between the general drift of the atmosphere at all levels, but when we turn to eastern Asia this is not the case. The excellent observations taken at the Observatory of Zikawei (Shanghai) show that at the surface and at the level of the lower clouds the prevailing direction is from the north during the winter and from the east, *i.e.* towards the low pressure system over the continent of Asia, during the summer; but already at the level of the intermediate clouds, and still more at higher levels, a steady drift from the west is found at all seasons. Similar results are shown by the observations from Japan.

Though there is substantial agreement in the mean direction of air motion over Europe at all levels, a general tendency for a component from the north to make its influence increasingly felt at higher altitudes is clearly shown. Thus at Upsala, during the winter months, the surface wind is from the south-west; the lower clouds travel from west-south-west and the intermediate ones from west-north-west, while at the cirrus level the direction of motion is from north-west. Further north, at Nora, in Swedish Lapland, cirrus moves from north-west throughout the year. Some particularly interesting results have been obtained from those of M. Teisserenc de Bort's balloon ascents in which the level of the highest cloud forms was exceeded. In all these cases the balloons were carried towards the south-east, showing that they met with a north-westerly wind in the uppermost layers of the atmosphere.

North-westerly winds at the cirrus level are also very prominent at Perpignan, Pola (Austria), Tiflis, and Madrid, stations which lie on the northern side of the tropical belt of high pressure, over which, as we have seen above, the direction of the anti-trade winds has become deviated from south-west to west.

Prof. Hildebrandsson sums up the results he has arrived at under the following headings:—

(1) Above the thermal equator and the equatorial calms there exists throughout the year a current from the east which appears to have a very high velocity at great altitudes.

(2) Above the trade winds, anti-trade winds from south-

west in the northern hemisphere and from north-west in the southern hemisphere prevail.

(3) These anti-trade winds do not extend beyond the polar limits of the trade winds; they are deviated to the right in the northern hemisphere and to the left in the southern, and become currents from the west above the tropical high pressure areas, where they descend to feed the trade winds.

(4) The air of the temperate zones is involved in vast "polar whirlpools," which rotate from west to east. This rotatory movement appears to be similar to that of ordinary cyclones; the air in the lower layers draws nearer to the centre of the whirl, while that in the upper layers recedes from it more and more as the height above the earth's surface increases up to the highest regions from which we have any observations.

(5) The layers of upper air of the temperate zones overflow the tropical high pressure areas, and there descend.

(6) The irregularities found at the surface of the earth, more particularly in the monsoon areas of India, disappear, as a general rule, at the level of the lower or intermediate clouds.

(7) The theory of a vertical circulation of the atmosphere between the tropics and the poles, which has hitherto been accepted (Ferrel, James Thomson), must be abandoned.

The report as published in the society's journal is very fully illustrated by reproductions of the diagrams of the original edition. M. Teisserenc de Bort's charts of the average distribution of pressure at the 4000-metre level for January and July are also given, and they illustrate in a very striking manner the scheme of general circulation of the upper air to which the results of Prof. Hildebrandsson's report point.

AMERICAN HYDROIDS.[1]

THE first part of this large work dealt with the plumularian hydroids. After an interval of four years, the second part, a folio of some 150 pages and 57 plates, has been issued. It appeals exclusively and intentionally to the student of systematic zoology; but owing to the wide distribution of the family—the "sea-firs" of our coasts—this account, though dealing primarily with American species, will assist students of sertularian taxonomy in almost any part of the world.

The plan of this book is that of the first part. There is first an anatomical account of the stem and its branches, then a *résumé* of the distribution, horizontal and vertical, in different seas, and finally a hundred pages of speciography. The most assiduous care has been employed in drawing up these descriptions and in illustrating them by well selected figures; and most critical and generous consideration is given to previous researches on this group of animals.

For some not very obvious reason, Prof. Nutting has decided to postpone the more interesting bearings of his subject to the final volume, and confines himself in the work before us rigidly to a consideration of the taxonomic and diagnostic features of the Sertularidæ. We look in vain for any explanation of the mode of distribution, though the occurrence of the majority in Alaskan and Arctic waters suggests a polar origin. There is no attempt to explain the absence of free medusæ, nor are we given any information as to the habits of these hydroids, their modes of growth and of repairing injury, the influence of light upon their branching and reproductive powers. There is not a single experiment recorded in the work, though it is to be expected from the plasticity of such cœlenterates that continuous and discontinuous variation may be induced by changes in environment. On the other hand, differentiating anatomical characters, such as the forms of branching, the shape of the gonidial sacs, and the opercula, are described and combined into a system with great care, and it is to be hoped that Prof. Nutting has laid the foundation of a permanent and authoritative classification.

[1] "American Hydroids. Part ii. Sertularidæ." By C. C. Nutting, Smithsonian Institution. U.S. National Museum. Special Bulletin. (Washington, 1904.)

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—The Vice-Chancellor has been informed that at a meeting of medical graduates recently held in London to consider the present provision in the university for the department of pathology, it was resolved (1) that steps should be taken to bring before the university the necessity of permanent and adequate support being received for the pathological department; (2) that a fund be started for the purpose of assisting in this object, and the primary object of this be the establishment and endowment of a professorship in pathology.

It was announced last term that the Rhodes trustees have made a grant for five years to Dr. Ritchie, the present reader in pathology, and New College has now elected him to an ordinary fellowship for seven years, provided that he continues his readership and does research work. Mr. Edward Whitley, Trinity College, has very generously given the university a thousand pounds towards the permanent endowment of a pathology chair.

CAMBRIDGE.—The Vice-Chancellor announces two important bequests which have been left to the university. The first consists of 5000*l.*, to be expended in improving the instrumental equipment of the Newall Observatory, and of a very valuable collection of illuminated manuscripts and early printed books and objects of mediæval and early art, to be placed in the Fitzwilliam Museum, left by Mr. Frank McClean, F.R.S., of Trinity College. The second bequest is left by the late editor of the *Athenæum*, Mr. Norman Maccoll, of Christ's and Downing Colleges, and consists of 500*l.* to form some endowment for a lectureship in Spanish or Portuguese, together with a valuable library of books.

The number of commissions allotted to the university, the first half-yearly nomination to which will take place after the examination in September next, is one in the Royal Artillery, one in the Indian Army, and five in the cavalry, Foot Guards, infantry, or the Army Service Corps.

The regulations for administering the Gordon Wigan fund are announced. The revenue will be divided between the special board of physics and chemistry and the special board of biology and geology, to be used in promoting and encouraging scientific education and research. The bequest amounts to some 9000*l.*

LONDON.—Mr. William Loring, late director of education under the County Council of the West Riding of Yorkshire, has been appointed warden of the Goldsmiths' College, New Cross, and Mr. Edgar Schuster Francis Galton research fellow in national eugenics.

The Mercers' Company has voted a sum of 1000*l.* to the university for the promotion of the study of physiology at University College.

Mr. W. Williams has been awarded the degree of doctor of science through a thesis on "The Temperature Variations of the Electrical Resistances of Pure Metals," and other contributions.

Mr. H. M. Hobart has been appointed lecturer in electrical engineering design at the Northampton Institute in succession to Mr. E. K. Scott, who has been appointed lecturer in electrical engineering in the University of Sydney. Mr. M. H. Smith has been appointed chief assistant in the mechanical engineering department in succession to Mr. W. E. Curnock, who has been appointed head of the mechanical engineering department of the Technical College, Huddersfield.

MANCHESTER.—The new public health laboratories, which have been erected by the Victoria University and have cost 13,000*l.*, were opened on January 27 by Mr. W. J. Crossley. Lord Spencer, Chancellor of the University, presided at the ceremony, and the large gathering included the Lord Mayor of Manchester and the Mayor of Salford. Honorary degrees were afterwards conferred upon Prof. Calmelle, Lille University; Prof. Perroncito, Turin University; Prof. Salomonsen, Copenhagen University; and Captain R. F. Scott, R.N.

IT has been resolved to institute, in the United College, University of St. Andrews, a lectureship in organic

chemistry, and to appoint Dr. James C. Irvine as the lecturer.

IT is reported in *Science* that, by the will of the late Mr. E. W. Codman, of Boston and Nahant, Mass., an estate which may reach 200,000*l.* will be equally divided between Harvard University and the Massachusetts General Hospital.

THE United States ambassador, Mr. Choate, has accepted the invitation of the governing body of the Battersea Polytechnic to distribute the awards and deliver an address on the occasion of the next annual distribution of prizes on Wednesday evening, February 22.

IT is reported in *Science* that Harvard University and the University of Berlin have practically arranged a method by which a temporary exchange of professors will occur. It is further stated that a similar arrangement has been made between the Massachusetts Institute of Technology and the Berlin Institute of Technology.

MR. J. D. ROCKEFELLER has signified his willingness to contribute to the University of Chicago for the year beginning July 1, 1905, the sum of 49,000*l.* for current expenses, this being the same sum that he has contributed during the present year. Mr. Rockefeller has also contributed this year 12,000*l.* for the enlargement of the heating plant of the university.

A COURSE of lectures and discussions has been arranged by the Childhood Society and the British Child-Study Association, to be delivered in the Parkes Museum, Margaret-street, W., and will commence on February 9. Among the subjects are:—Some physiological problems in education; the proposed anthropometric survey; mental faculty of the child: its growth and culture; fatigue in children; the health of children *qua* food and management; and imitation.

AT the annual conference of representative Mahomedans from all parts of India, held at Lucknow a month ago, it was agreed to form science faculties at Aligarh College. The list of subscriptions towards this object was headed by the Raja of Mahmudabad with a munificent donation of Rs.35,000. The aggregate subscriptions to the fund for promoting the advancement of Aligarh College to the status of a university, which will be the future university of Mahomedans in India, now amounts to Rs.1,04,000 (7000*l.*).

IN connection with the fund instituted to supplement the resources of the Melbourne University, the Hon. F. S. Grimwade has given 1000*l.* for the purpose of founding an annual prize at the university, to be awarded in respect of research work in some branch of industrial chemistry. This donation, says the *Pharmaceutical Journal*, raises the fund to 11,000*l.*, and enables the university to claim a subscription of 1000*l.* promised by Mr. Andrew Carnegie. The whole of the money subscribed, which, with a Government grant of 12,000*l.*, now totals 24,000*l.*, is to be devoted to the purpose of building laboratories. The Government has promised a supplementary grant of 5000*l.* next year.

THE need for a university in the south-west of England continues to be urged locally from time to time. At the recent ordinary general meeting of the governors of University College, Bristol, Mr. Henry Hobhouse said that it was unfortunate that the south-west of England was almost the only part of England and Wales that had no local university, and spoke of Bristol as the only possible centre for such an institution. Principal Lloyd Morgan, F.R.S., who returned recently from a visit to the United States, gave it as his opinion, after inspecting the equipment and work of the American university colleges, that when the amount of work done by the staff of Bristol University College is compared with the amount being done in any one of the American institutions he had visited, and the cost of the one is compared with the cost of the other, Bristol University College is ahead of them all. Several speakers urged the pressing need for more funds. In this connection we are glad to notice that the college received last year nearly 5000*l.* in donations outside the ordinary income.

THE Association of Technical Institutions held its annual general meeting on January 27 at the Manchester School of Technology. Sir Philip Magnus was elected president of the association for 1905, and in the course of his address directed attention to the fact that in technical institutions the students who attend even the most elementary technological classes are too often insufficiently prepared to profit by the teaching. They are deficient in power of expression; they lack practical knowledge of arithmetic and the rudiments of science and the necessary skill in drawing. In a word, the training in the elementary schools of the country has not produced satisfactory results. The elementary teaching must be made more practical. The workroom will supersede the class room in elementary schools, continued Sir Philip Magnus, and manual training will become the central feature of the training around which other studies will be grouped. Numerous papers were read. Principal Reynolds, of Manchester, Mr. Wilkinson, of Bolton, and Principal Crowther, of Halifax, read papers on the co-ordination of the work of evening continuation schools and municipal technical institutions. The co-operation of employers in the technical training of their apprentices was the subject of a discussion opened by Principal Belcher, of Coventry, and Principal Gannon, of Norwich. The registration of teachers in technical institutions was dealt with by Principal Wells, of Battersea.

THE report of the council of the Association of Technical Institutions was presented at the annual general meeting on January 27. The report states that, from the point of view of those specially concerned with technical education, the year 1904 has been marked chiefly by the development and coordination of local educational organisation and by the perfecting of matters of internal administration. It is too soon, the report states, to say what the effects of the abolition of the Technical Instruction and Local Taxation (Customs and Excise) Acts and the placing of all branches of education under one local authority may have upon the further extension of technical education. While recognising the possible danger to these interests of the large and growing demand for expenditure upon other branches of education, the association views with satisfaction the increasing recognition of the belief that technical education can only produce the best results when it builds upon the sure foundation of a sound secondary education. Among matters to which the association has given attention may be mentioned that of the possibility of obtaining a number of research scholarships, tenable by advanced students in technical institutions; and that of the desirability of instituting a scheme for the issue by technical institutions of diplomas upon some common basis of award. This last question is of such importance that it has been referred to a subcommittee for further inquiry and report.

THE annual meeting of the Mathematical Association was held at King's College on January 28. Prof. G. B. Mathews, F.R.S., was elected president for the ensuing year. Papers were read on models and their uses by Mr. E. M. Langley, and on the new geometry by Mr. W. H. Wagstaff, who does not think it is desirable to make all boys learn deductive geometry, but that some should learn logic instead, and that some training in practical geometry should be given to all. A discussion on the question: "Should Greek be Compulsory for Mathematicians at Cambridge?" was opened by Mr. A. W. Siddons, who urged that mathematicians should not have special arrangements made for them; that, if Greek was compulsory for others, it should be for mathematicians also. Prof. A. R. Forsyth, F.R.S., said it is to his mind extraordinary that teachers of classics argue that, if Greek be made optional, therefore the subject will become extinct. The subject has a strong hold on the public schools and the universities; every outside inducement to its continuation is still maintained, but in a large number of schools in the country Greek is now extinct. If the ancient universities maintain this barrier of Greek as a preliminary qualification for a degree, it means one of two things—either that all the boys in those schools where Greek is now extinct are cut off from the universities, and so those institutions cease to be contributing to the educational

wealth of the country to the same extent as they used to do, or else that many boys often proceed to get up the subject from the point of view of satisfying a miserable minimum. What was asked for is a relaxation in favour of education in general and not in favour of any special class of people. The elimination of literary training in the country is not being sought.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, November 24, 1904.—"Preliminary Communication on Galvanic Cells produced by the Action of Light." By Dr. M. **Wilderman.** (From the Davy-Faraday Laboratory of the Royal Institution.)

The author finds that there is, under the action of light, a region of galvanic cells as wide and as varied as in the case of ordinary galvanic cells. He finds constant and inconstant cells, reversible and irreversible cells. The chemical reactions and chemical equilibrium in the galvanic combinations are now perfectly clear; they prove, however, to be all *sui generis*, all the phenomena being intermixed and characterised by phenomena of induction and deduction, peculiar to light cells only. The author also succeeded in placing this region of phenomena on a physico-mathematical basis, testing and proving the fundamental equations experimentally in all details. The principal results obtained are:—

(1) The total E.M.F. created by light consists of an E.M.F. produced by light at a constant temperature, owing to the increase of the chemical potential and of the solution pressure of the exposed plate, and of a thermo-E.M.F. caused by one of the plates in contact with the liquid being heated by light. Both E.M.F.'s are found to be directly proportional to the intensity of light; both give currents in the same direction, thus proving that light acts on the chemical potential as well as on the solution pressure of the electrode in the same way as does heat.

(2) The peculiar course of the induction and deduction periods enables one to distinguish constant and inconstant cells showing polarisation from one another. A consideration of the chemical composition and of the reactions going on in the systems under the action of the current leads to the same results.

(3) The induction period follows a law

$$d\pi/d\tau = c(\pi_0' - \pi)\,(\pi - \pi_0 + \mathrm{K}),$$

giving at the same time also the fundamental law of photography relating to the connection between the amount of silver salts decomposed and the time of exposure. The deduction period follows a similar law

$$-d\pi/d\tau = -c'(\pi_0 - \pi)\,(\pi - \pi_0' + \mathrm{K}').$$

(4) The fundamental equation for the E.M.F. of constant cells "reversible in respect of cation" (*e.g.* Ag plate in light, $AgNO_3$ solution in light, $AgNO_3$ solution in the dark, Ag plate in the dark) is

$$\Sigma E = 0{\cdot}860T\,(\log_e P_l/P_d - 2v/u + v\log_e p_l/p_d)10^{-4}\ \text{volt},$$

and for constant cells "reversible in respect of the anion" (*e.g.* Ag-BrAg plate in light, KBr solution in light, KBr solution in the dark, Ag-BrAg plate in the dark) is

$$\Sigma E = 0{\cdot}860T(-\log_e P_l/P_d + 2u/u + v\log_e p_l/p_d)10^{-4}\ \text{volt},$$

where P_l, P_d are the solution pressures of the electrodes in light and in dark, p_l, p_d are the osmotic pressures of the cation or anion in the solution in light and in dark, and T is the absolute temperature.

The theory of thermogalvanic cells is also given in the paper.

December 8, 1904.—"The *Rôle* of Diffusion during Catalysis by Colloidal Metals and Similar Substances." By Dr. Henry J. S. **Sand.** Communicated by Prof. J. H. Poynting, F.R.S.

This paper contains a criticism of the opinion expressed by Nernst (*Zeitschrift Phys. Chem.*, xlvii., 55) that the catalytic decomposition of hydrogen peroxide due to colloidal metals probably takes place practically instantaneously on the surface of the catalyser, so that the concentration of the hydrogen peroxide there is permanently maintained at zero, and the velocity of the reaction actually measured is that with which diffusion and convection renew the solute in contact with the catalytic particles.

As a result, it was shown that Nernst's hypothesis would lead us to expect the reaction to proceed as one of the first order, a conclusion which agrees with the experimental results found by Bredig and his pupils. The actual values of the experimental velocity-constants are, however, far too small to allow us to reconcile them with Nernst's suggestion, and the latter must therefore be rejected.

In order to arrive at this result, minimum theoretical values for the rate of the reaction were calculated on Nernst's hypothesis. For this purpose the particles were assumed to be spheres with a diameter of $0{\cdot}5\mu$, a value which, according to Bredig, is greater than any which was met with in his solutions. The particles were supposed to be in a state of continual movement, performing the so-called Brownian motions, but in travelling through the solution were assumed to take with them a film of adhering liquid. In order to obtain a minimum value for the reaction velocity the total volume of the films was supposed to be equal to that of the whole liquid. The diffusion-coefficient of hydrogen peroxide at 25° was taken as 10^{-5} cm.^{2}/sec., a value which is smaller than that of most substances with heavier molecules.

The great part played by convection due to the Brownian motions of the particles and stirring by gases, &c., was demonstrated, it being pointed out that the experimental results regarding the dependence of the velocity-constants on the concentration of the catalyser can only be reconciled with the idea of a heterogeneous reaction if convection plays an important part.

Lastly, it was shown that the experimental facts all agree with the assumption that the actual velocity of the reaction on the surfaces of the particles always has a finite value which is proportional to the concentration of the solute in immediate contact with them.

In conclusion, Nernst's views regarding reaction-velocities in heterogeneous systems were criticised from a thermodynamical point of view, and it was shown that whereas they may possibly be correct for the majority of physical processes, great caution should be exercised in applying them to processes of a chemical nature.

January 19.—"The Dual Force of the Dividing Cell. Part i.—The Achromatic Spindle-Figure, elucidated by Magnetic Chains of Force." By Prof. Marcus **Hartog.** Communicated by Sir William T. Thiselton-Dyer, K.C.M.G., C.I.E., F.R.S.

The essential points of this research are described as:—

(1) The introduction of a convenient apparatus for the study of the axial section of fields produced by isolated poles of a dual force.

(2) The formation of *chains of force* in a viscid material, the recognition of their character as a distinct type of material configuration, and the study of their properties.

(3) The application of the conception of *relative permeability*, and of the recognition of chains of force to the problem of the cell-figure.

Zoological Society, January 17.—Mr. G. A. Boulenger, F.R.S., vice-president, in the chair.—(1) Some notes on the cranial osteology of the mastigure (Uromastix); (2) a contribution to the anatomy of Chlamydosaurus and some other Agamidæ; and (3) a note on the brain of *Cynopithecus niger*: F. E. **Beddard,** F.R.S.—(1) A collection of sipunculids made at Singapore and Malacca; (2) a collection of gephyrean worms from Zanzibar; and (3) the sipunculids and echiurids collected during the "Skeat Expedition" to the Malay Peninsula: W. F. **Lanchester.** Four new species were described in the second paper and nine in the last.—On the oral and pharyngeal denticles of elasmobranchs: A. D. **Imms.** The author had found that these denticles were present in varied abundance over the mucous membrane lining both the oral and pharyngeal cavities in many of these fishes. Out of the specimens of the nineteen species

(representing eighteen genera) examined, only five, belonging to as many genera, were found to be totally devoid of these structures.—The skull of a musk-ox from the river-gravels of the Severn Valley at Frampton-on-Severn, near Stonehouse, Gloucestershire: Dr. C. W. **Andrews.** The specimen consisted of the cranial portion of the skull of an old bull, and was found by Mr. W. T. Rennie, of Chepstow, who had presented it to the British Museum. Remains of this species were comparatively rare in Britain, and the nearest previously recorded locality to that described was Barnwood, near Gloucester.—Three new birds obtained by Colonel Waddell, C.B., on the recent expedition to Lhassa: H. E. **Dresser.** The birds exhibited and described were:—*Babax waddelli,* nearest to, but differing widely from, *Babax lanceolatus*; *Garrulax tibetanus,* a much darker and more uniformly coloured bird than *Garrulax sannio,* with the terminal part of the tail white; and *Lanius lama,* a much darker bird than *Lanius schach,* with less white on the forehead, no rufous on the back or scapulars, and no trace of an alar speculum.

Royal Meteorological Society, January 18.—Capt. D. Wilson-Barker, president, in the chair.—The **President** delivered an address on the connection of meteorology with other sciences. He said that meteorology and astronomy were doubtless the first of the sciences to attract the attention of men—which of the two exerts most influence on the well-being of humanity is a matter dependent on the position of the globe; in many regions people are but slightly affected by the weather, while the heavenly bodies, particularly the sun, exert an enormous influence on human life. Everywhere in nature we find the effects of meteorological agencies. After speaking upon the effects of evaporation, winds, rain, ice, snow, and pointing out the influence of weather on animal life, vegetation, health, &c., he said that meteorology is a science deserving more attention than it receives. He thought it ought to be recognised as a preliminary to the studies of geography, geology, and kindred subjects, and he was of opinion that meteorological observatories might very well be fitted up in schools, and pupils taught to observe. This could be done at a small cost of time or money. The tendency at present is to particularise in all scientific work, but the true path to progress lies in keeping a comprehensive outlook on the whole field of investigation. The United States have devoted much attention to meteorology with most satisfactory results. It is to be regretted that official help and encouragement are so deficient in this country. The baffling, difficult nature of meteorological problems should but serve as an incentive to their elucidation. The persistent observer gains much, not only in knowledge of the subject, but in the habits of close and accurate investigation which he insensibly acquires, and all workers in this field learn to appreciate the difficulties which confront their fellow-labourers and to recognise the value of what has been done by the meteorological organisations of the world.—Mr. Richard Bentley was elected president for the ensuing year.

Entomological Society, January 18.—Prof. E. B. Poulton in the chair.—Mr. F. Merrifield was elected president for the session 1904–5.—The president, Prof. **Poulton,** delivered an address in which he discussed the part played by the study of insects in the great controversy on the question, "Are acquired characters hereditary?" He argued that the decision whether Lamarck's theory of the causes of evolution is or is not founded on a mistaken assumption largely depends upon evidence supplied by the insect world, and finally concluded that the whole body of facts strongly supports Weismann's conclusions. At the end of his address the president urged that the study of insects is essential for the elucidation and solution of problems of the widest interest and the deepest significance.

DUBLIN.

Royal Dublin Society, December 20, 1904.—Mr. W. E. Wilson, F.R.S., in the chair.—Unrecognised factors in the transmission of gases through water: Dr. W. E. **Adeney.** The author has described in this communication an experimental investigation of the downward streaming which has been met with in experiments on diffusion of gases in water, when the gas is placed above the water. Hüfner has ascribed this downward streaming to the water becoming heavier as it dissolves the gas, and so forming concentration currents. The author shows from his experiments that the streaming is a gravitational effect, but that it is not due to concentrated solution currents as understood by Hüfner. He also shows that when the surface layers of long columns of water, of small cross section, are continuously agitated by mechanical stirrers, or by currents of air drawn through them, the streaming becomes very rapid, with the result that the columns of water are saturated with the gas in the course of a few hours. The streaming takes place more rapidly in sea-water than in distilled water.—Secondary radiation: Prof. J. A. **McClelland.**—The partial differential equations of mathematical physics: Prof. A. W. **Conway.** A new method of obtaining singular solutions of these equations was obtained, applicable to non-homogeneous equations. A new class of functions called "kinetic functions" was introduced.—The Primary rocks of Ireland with their intrusive rocks: G. H. **Kinahan.** The first part of the paper gave a general account of the rocks from the Permian to the Cambrian, specially mentioning their characteristic shore accumulations. The second and more important portion treated of all the occurrences of Irish Archæans with their exotic adjuncts, and their probable equivalents in England, Wales, Scotland, Canada, and the United States of America.

January 17.—Dr. W. E. Wilson, F.R.S., in the chair.—Improvements in equatorial telescope mountings: Sir Howard **Grubb,** F.R.S. The author described a new form of slow motion for large equatorial telescopes in which a small electric motor is used for actuating the differential wheels, which are ordinarily worked by an endless cord. This new form was first applied to the 24-inch photographic equatorial of the Radcliffe Observatory, Oxford, and is now being applied to the photographic equatorial at the Cape Town Observatory, which is of the same size. The working of the instrument, which was exhibited at the meeting, was demonstrated by the author, who also read a paper on a simplified form of his electrical control, which has lately been applied to several large instruments.—On the temperature of certain stars: W. E. **Wilson,** F.R.S. It seems probable that in the sun and some stars there are two quite distinct sources from which we can receive light which gives a continuous spectrum. First, the photospheric clouds, which are composed of droplets of matter in the solid form, probably carbon; secondly, layers of intensely hot gases which are under considerable pressure. Between these two sources of radiation lie principally the vapours of titanium and vanadium, and other elements of suitable atomic weight. In a sun-spot the temperature is locally so high that the photospheric clouds are volatilised, and we then get the radiation only from the gaseous layer below, the spectrum being darkened by the intervening layers, consisting principally of the vapours of titanium, &c., the lines of which are widened and darkened. It is then suggested that as a star like Arcturus, or type iv. stars, have a spectrum which is very similar to a sun-spot, in these bodies the temperature is so high that they have no photospheric clouds, and that their want of brilliancy is caused by their only receiving the radiations from the gaseous layers which lie at some depth in their atmospheres.—Mr. Richard J. **Moss** exhibited the absorption spectrum of liquid oxygen.

MANCHESTER.

Literary and Philosophical Society, December 13, 1904.—Mr. W. H. Johnson in the chair.—Note on the dissemination of seeds by birds: C. **Oldham.** The opinion expressed by Mr. F. Nicholson at a recent meeting of the society that birds rarely act as disseminators of seeds, by voiding them in their excrement, is not in accord with the experience of many field naturalists. Nearly fifty years ago Darwin proved ("Origin of Species," chapter xii.) that certain seeds extracted from the excrement of small birds germinated, as did others from the ejected pellets and the excrement of carnivorous and piscivorous birds. The evidence of Wallace and other observers may be cited to the same effect. In mid-Cheshire, during the spell of hard weather at the end of November, 1904, an examination of

the excrement of various birds showed that entire and apparently uninjured seeds are voided constantly. Redwings, fieldfares, and other thrushes were compelled during the frost to subsist largely upon hedgerow fruit, and entire seeds of the wild rose (Rosa) and hawthorn (Cratægus), among others, might have been collected from their droppings by thousands. From the excrement of smaller birds the author obtained many undigested seeds of the bramble (Rubus).—The Foraminifera from the coast of the island of Delos, part ii.: H. **Sidebottom.** Particular attention was directed to those species that are new to the Mediterranean. The dimorphic structure of many of the Foraminifera was also pointed out.

January 10.—Prof. W. Boyd Dawkins, F.R.S., in the chair.—On the supposed antagonism of Mendelian to biometric theory: A. D. **Darbishire.** The author, after referring to the conflict of the Mendelians and biometricians, explained the methods of investigation of the two schools. The biometricians apply statistical methods and deal with masses of individuals, and therefore with average characters; the Mendelians devote their attention to the study of the individual components of the mass, and endeavour by means of experiments to ascertain the nature and mode of modification of the characters of the units. Mr. Darbishire sought to show that the two views are not irreconcilable, but that the real truth was to be arrived at from a survey of both.—The cause of the period of chemical induction: C. H. **Burgess** and D. L. **Chapman.**

PARIS.

Academy of Sciences, January 23.—M. Troost in the chair.—New researches on the secular alterations of hydrocarbon of organic origin: M. **Berthelot.** Details are given of the chemical examination of a fatty substance found in an Egyptian vase of about 1600 B.C.—Some metals found in archæological excavations in Egypt: M. **Berthelot.** Analyses of two specimens of bronze dating from about the second dynasty.—On the increase of volume of molten cast iron, saturated with carbon in the electric furnace, at the moment of solidification: Henri **Moissan.** Iron which is free, or nearly free, from carbon, in passing from the liquid to the solid state, follows the ordinary law, its density increasing. On the contrary, when saturated with carbon at the temperature of the electric furnace, it increases in volume when solidifying.—Study of lunar photographs. Considerations on the course of solidification in the interior of a planet: MM. **Lœwy** and **Puiseux.** As the result of an examination of photographs of the moon's crust, the author has been led to support the geological view of the constitution of the earth, that of a thin crust with a liquid core, as against the rigid solid theory of the mathematicians.—Note on the three volumes of the *Annales de l'Observatoire de Nice*: M. **Bassot.**—On a recent ascent of Vesuvius: J. **Janssen.** Numerous specimens of gases from the fumerolles and of lava and scoria were collected, and photographs taken of the absorption spectra of the vapours issuing from the cone during an eruption. The description of a detailed examination of these is reserved for a future communication.—The calculation of ordinary and suspension bridges: M. **Considère.**—Observations of the Borrelly comet (1904 *e*) made by F. Courty with the large equatorial at the Observatory of Bordeaux: G. **Rayet.**—On families of surfaces with plane orthogonal trajectories: S. **Carrus.**—Remarks on the preceding communication: Gaston **Darboux.**—On the approximation of functions by polynomials considered in relation with the theory of partial differential equations: application to the problem of the initial state in mathematical physics: A. **Buhl.**—On a hyperelliptic surface: E. **Traynard.**—On the integrals of total differentials belonging to an irregular surface: G. **Castelnuovo.**—On linear differential equations of the second order containing one parameter: M. **Tzitzeica.**—On a theorem of M. Borel: F. **Riesz.**—On the deviation of falling bodies towards the south and on the curvature of lines of force: Maurice **Fouché.**—On the magnetic field to which a body in motion in an electric field is submitted: H. **Pellat.**—On the ions of the atmosphere: P. **Langevin.** The experiments of the author lead to the conclusion that there are only two kinds of ions present in the air, one having a mobility several thousand times smaller than the other. The apparatus used by Ebert only measures the first of these.—Contribution to the study of ionisation in flames: Pierre **Massoulier.**—On the specific coefficients of magnetisation of liquids: Georges **Meslin.**—The action of very low temperatures on the phosphorescence of certain sulphides: F. P. **Le Roux.** Remarks on a paper of MM. A. and L. Lumière dealing with the same subject.—On a new mineral containing radium: J. **Danne.** Some plumbiferous minerals, notably a pyromorphite, found in the neighbourhood of Issy-l'Évêque, have been found to contain radium, and it is a noteworthy fact that none of these minerals contain uranium. The amount of radium is variable, a ton of the mineral furnishing quantities of radium bromide of the order of a centigram.—The dissociation of strychnine salts as measured by the rotatory power. The rotatory power in homologous series. The influence of the double linkage: J. **Minguin.** The deviations were measured in the first place when the strychnine and acid were present in molecular quantities, and then in presence of an excess of acid. The differences observed point to a dissociation taking place.—On cæsium methylamide: E. **Rengade.** Cæsium dissolves in anhydrous liquid methylamine, forming at first a metal methylammonium; this soon evolves hydrogen and the methylamide is quantitatively formed. The amide detonates on heating, giving rise to cæsium cyanide and hydrogen. Water, allowed to act slowly, produces cæsium hydroxide and methylamine.—The action of phosphorus pentachloride upon some tertiary cyclic amines. Syntheses of colouring matters and formation of phosphorus: P. **Lemoult.**—The products of oxidation of anthracene octahydride: dihydro-oxanthranol and hexahydroanthrone: Marcel **Godchot.**—Thymomenthol and its derivatives: Léon **Brunel.** This is obtained from thymol by the Sabatier and Senderens reaction; its physical and chemical properties are given and the preparation of several derivatives described.—Contribution to the study of some derivatives of benzodihydrofurfurane: A. **Guyot** and J. **Catel.**—On the agricultural value of humic materials: J. **Dumont.**—On the elliptical character of the new Borrelly comet (*e* 1904): G. **Fayet.** It is shown that no parabola can satisfactorily represent all the observations, an elliptical orbit with a period of about eight years better representing the facts.—An electrical pendulum with free escapement: Ch. **Féry.** The arrangement described is remarkable for the small expenditure of electrical energy required to work it, less than 0.5 watt per annum. The diurnal variation of a clock beating half seconds fitted with the apparatus described is less than 0.3 second.—On the nitrates of potassium and ammonia and on the law of Bravais: Frédéric **Wallerant.**—The coal basin of French Lorraine: Francis **Laur.**—On the diatom-bearing level of the ravine of Égravats, near Mont Dore, Puy-de-Dôme: M. **Lauby.**—On the biology and anatomy of the suckers of *Osyris alba*: A. **Fraysse.**—On the biology of the Cestodæ: L. **James** and H. **Mandoul.**—The action of magnesium and of magnesia on micro-organisms: F. **Dienert.**

NEW SOUTH WALES

Royal Society, November 2, 1904.—Mr. C. O. Burge, president, in the chair.—Pot experiments to determine the limits of endurance of different farm crops for certain injurious substances, part iii., barley and rye: R. **Helms** and Prof. F. B. **Guthrie.** The authors describe experiments with barley and rye in continuation of those on wheat and maize (*Proc.* Roy. Soc. New South Wales, xxxvi. p. 191, and xxxvii. p. 165) to determine the tolerance of these plants to certain ingredients commonly present in the soils and water used for irrigating in certain parts of the State, namely, sodium chloride and sodium carbonate; also the effect produced upon their growth by the presence of small quantities of plant poisons occasionally met with in fertilisers, such as ammonium sulphocyanide, sodium chlorate, and arsenious acid.—The classification and systematic nomenclature of igneous rocks: H. Stanley **Jevons.** The author concludes that the most convenient general classification for the present time would be one constructed as follows:—(1) Based on alkali-lime-content of principal and minor mineral constituents. Produces two series: alkaline and calcic. (2) Based on similarity of

principal mineral constituents. Produces seven sections, *e.g.* granitic, gabbroic, theralitic, &c. (3) Based on community of origin from similar parent magmas. The latter are defined by the presence of certain index minerals in the consolidated rocks (*e.g.* a granite, a granite-aplite, and a rhyolite, &c., may all be derived from one magma; other granites, rhyolites, &c., will be derived from similar magmas). Produces twelve orders, *e.g.* granates, essexates, &c. (4) Based on habit of mass. Produces seven families in each order, *e.g.* granophites, dioromicrites, gabbrolavites (basalts), &c. (5) Based on nature of minor mineral constituents. Produces a number of genera in each family, *e.g.* muscbigranophite, anaugi-hyper-peridotite (harzburgite). (6) Based on texture, but to be applied only in families where there is much variety of texture. Produces subgenera, *e.g.* spheri-mono-rhyolite, graphi-bi-rhyolite, &c. The system of nomenclature described is an elaboration of that already proposed by the author in a preliminary paper in the *Geological Magazine* (1901).

BENGAL.

Asiatic Society of Bengal, January 4.—Hierarchy of the Dalai Lama (1406–1726): Rai Sarat **Chandra Das.** The author gives a history of the origin and growth of power of the Dalai Lama.—On the prevalence of fevers in the Dinajpur district: Dr. L. **Rogers.** This paper deals with the results of a special inquiry into the causes of the very high mortality of above forty per thousand in the Dinajpur district. It is shown that the higher death rates in certain places are due mainly to malaria, the increased prevalence of which is closely related to a high ground water level due to unalterable physical conditions of the district. In the second part of the paper the varieties of fever met with and distribution of the anopheles which can carry the infection are dealt with, and the impracticability of mosquito destruction as a preventive measure in the district as a whole is pointed out. The wider distribution of quinine in each village through the agency of the primary schoolmasters so as to reach the children, who mainly die of the disease, is recommended as the only practicable method of lessening the death rates from malaria among the people of Lower Bengal.

DIARY OF SOCIETIES.

THURSDAY, FEBRUARY 2.

ROYAL SOCIETY, at 4.30.—On the Compressibility of Gases between One Atmosphere and Half an Atmosphere of Pressure: Lord Rayleigh, O.M., F.R.S.—On the "Blaze Currents" of the Gall Bladder of the Frog: Mrs. A. M. Waller.—The Theory of Photographic Processes: On the Chemical Dynamics of Development: S. E. Sheppard and C. E. K. Mees.—On the Relation between Variations of Atmospheric Pressure in North-East Africa, and the Nile Flood: Capt. H. G. Lyons.—Note on the Determination of the Volume Elasticity of Elastic Solids: Dr. C. Chree, F.R.S.—Theory of the Reflection of Light near the Polarising Angle: Prof. R. C. Maclaurin.

ROYAL INSTITUTION, at 5.—Forestry in the British Empire: Prof. W. Schlich.

CIVIL AND MECHANICAL ENGINEERS' SOCIETY, at 8.—The Mechanics of Flour Milling: A. R. Tattersall.

LINNEAN SOCIETY, at 8.—Descriptions of New Chinese Plants (with lantern slides): W. J. Tutcher.—European Cirolaninæ (Isopoda): Dr. H. J. Hansen.

RÖNTGEN SOCIETY, at 8 15.—Some Points in the Construction of a High Frequency Machine: Dr. Clarence A. Wright.

CHEMICAL SOCIETY, at 8.—Studies in the Camphane Series. Part xvi. Camphorylcarbimide and Isomeric Camphorylcarbamides: M. O. Forster and H. E. Fierz.

FRIDAY, FEBRUARY 3.

ROYAL INSTITUTION, at 9.—Blood Pressure in Man: Prof. T. Clifford Allbutt, F.R.S.

GEOLOGISTS' ASSOCIATION, at 7.30.—Address on Modern Methods in the Study of Fossils: the President, Dr. A. Smith Woodward, F.R.S.

MONDAY, FEBRUARY 6.

SOCIETY OF CHEMICAL INDUSTRY, at 8.—The Theory of Dyeing. Part ii. Pseudo-solution and Desolution: W. P. Dreaper.—The Fading of Inks and Pigments: J. W. Lovibond.

SOCIETY OF ARTS, at 8.—Fountain Pens: James P. Maginnis.

TUESDAY, FEBRUARY 7.

ROYAL INSTITUTION, at 5.—The Structure and Life of Animals: Prof. L. C. Miall, F.R.S.

ZOOLOGICAL SOCIETY, at 8.30.—On Abnormal Ranid Larvæ from North-eastern India: Nelson Annandale.—On a Second Collection of Fishes made by S. L. Hinde in the Kenya District, East Africa: G. A. Boulenger, F.R.S.—On some Points in the Anatomy of Diademodon: Dr. R. Broom.—Notes on the Mammals of Southern Cameroons and the Benito: George L. Bates.

INSTITUTION OF CIVIL ENGINEERS, at 8.—*Discussion*: Floating Docks: L. E. Clark.—*Papers*: Alfreton Second Tunnel: E. F. C. Trench.—The Reconstruction of Moncreiffe Tunnel: Dugald McLellan.

WEDNESDAY, FEBRUARY 8.

SOCIETY OF ARTS, at 8.—Time Development in Photography, and Modern Mechanical Methods of carrying it out: R. Child Bayley.

THURSDAY, FEBRUARY 9.

ROYAL SOCIETY, at 4.30.—*Probable Papers*: (1) On the Conversion of Electric Oscillations into Continuous Currents by means of a Vacuum Valve: (2) On a Kummeter for the Measurement of the Length of Long Electric Waves, and also small Inductances and Capacities: Prof. J. A. Fleming, F.R.S.—Report on an Area of Local Magnetic Disturbance in East Loch Roag, Lewes, Hebrides: Captain A. M. Field, R.N.—Phosphorescence caused by the Beta and Gamma Rays of Radium: G. T. Beilby.—(1) The Spectrum of Scandium and its Relation to Celestial Spectra; (2) Note on the Spectrum of μ Centauri; (3) On the Stellar Line near λ 4686: Sir Norman Lockyer, K.C.B., F.R.S., and F. E. Baxandall.—On Europium and its Ultra-Violet Spectrum: Sir William Crookes, F.R.S.

ROYAL INSTITUTION, at 5.—Forestry in the British Empire: Prof. W. Schlich, F.R.S.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Fuel Economy in Steam Power Plants: W. H. Booth and J. B. C. Kershaw. (Conclusion of discussion.)—The Value of Overhead Mains for Electric Distribution in the United Kingdom: G. L. Addenbrooke.

MATHEMATICAL SOCIETY, at 5.30.—General Theory of Transfinite Numbers and Order-types: Dr. E. W. Hobson.—On the Reducibility of Covariants of Binary Quantics of Infinite Order. Part ii: Mr. P. W. Wood.

FRIDAY, FEBRUARY 10.

ROYAL INSTITUTION, at 9.—The Art of the Ionian Greeks: Dr. Cecil Smith.

ROYAL ASTRONOMICAL SOCIETY, at 5.—Anniversary Meeting.

MALACOLOGICAL SOCIETY.—Annual General Meeting. Address by the President, Mr. E. R. Sykes, on Variation (including Teratology) in Recent Mollusca.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Reconstruction of the Santa Lucia River Bridge, Uruguay: P. J. Risdon.

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