THURSDAY, NOVEMBER 26, 1896.

SIR JOSEPH BANKS'S JOURNAL.

Journal of the Right Hon. Sir Joseph Banks, Bart., K.B., P.R.S., during Captain Cook's First Voyage in H.M.S. "Endeavour" in 1768–71 to Terra del Fuego, Otahite, New Zealand, Australia, the Dutch East Indies, &c. Edited by Sir Joseph D. Hooker. Pp. li + 466. (London: Macmillan and Co., Ltd., 1896.)

THIS journal, which now sees the light after varying vicissitudes, will take fitting place on our bookshelves by the side of Darwin's "Voyage of the *Beagle*" and Moseley's "*Challenger* Notes" as one of the classics of scientific travel. Sir Joseph Hooker, in realising a hope he has indulged, as he tells us, since he was a boy, adds another to the many services he has rendered to science by presenting to us this journal in the delightful form it has assumed under his editing. In an interesting preface to the volume he states the aims with which he has undertaken the task he has just completed, and from this, as well as from the charming biographical notice with which the journal is introduced, we do not scruple to quote in noticing with gratitude the appearance of this book.

"My principal motive," he says, "for editing the journal kept by Sir Joseph Banks during Lieut. Cook's first voyage round the world is to give prominence to his indefatigable labours as an accomplished observer and ardent collector during the whole period occupied by that expedition, and thus to present him as the pioneer of those naturalist voyagers of later years, of whom Darwin is the great example. This appears to me to be the more desirable, because in no biographical notice of Banks are his labours and studies as a working naturalist adequately set forth." . . . "In respect of Cook's first voyage, this is in a measure due to the course pursued by Dr. Hawkesworth in publishing the account of the expedition, when Banks, with singular disinterestedness, placed his journal in that editor's hands, with permission to make what use of it he thought proper. The result was that Hawkesworth selected only such portions as would interest the general public, incorporating them with Cook's journal, often without allusion to their author, and not unfrequently introducing into them reflections of his own as being those of Cook or of Banks. Another motive for editing Banks's journal is to emphasise the important service which its author rendered to the expedition. It needs no reading between the lines of the great navigator's journal, to discover his estimation of the ability of his companion, of the value of his researches, and of the importance of his active co-operation on many occasions. It was Banks who rapidly mastered the language of the Otahitans, and became the interpreter of the party, and who was the investigator of the customs, habits, &c., of these and of the natives of New Zealand. It was often through his activity that the commissariat was supplied with food. He was on various occasions the thief-taker, especially in the case of his hazardous expedition for the recovery of the stolen quadrant, upon the use of which, in observing the transit of Venus across the sun's disc, the success of the expedition so greatly depended. And, above all, it is to Banks's forethought, and at his own risk, that an Otahitan man and boy were taken on board, through whom Banks directed, when in New Zealand, those inquiries into the customs of the inhabitants, which are the foundation of our knowledge of that interesting people. And when it is considered that the information obtained was at comparatively few points, and those on the coast only, the fulness and accuracy of the description of the New Zealanders, even as viewed in the light of modern knowledge, are very remarkable. Nor should it be forgotten that it was to the drawings made by the artists whom Banks took in his suite that the public is indebted for the magnificent series of plates that adorn Hawkesworth's account of the voyage. Still another motive is, that Banks's journal gives a life-like portrait of a naturalist's daily occupation at sea and ashore nearly one hundred and thirty years ago; and thus supplements the history of a voyage which, for extent and importance of geographic and hydrographic results, was unique, and 'to the English nation the most momentous voyage of discovery that has ever taken place' (Wharton's 'Cook,' Preface), and which has, moreover, directly led to the prosperity of the empire; for it was owing to the reports of Cook and Banks, and, it is believed, to the representation of the latter on the advantages of Botany Bay as a site for a settlement, that Australia was first colonised."

The question that every one will no doubt ask himself is, how does it come about that a journal of so much interest, written in 1769–71, the author of which survived until 1820, occupying for no less a period than forty years the premier position in the scientific world in Great Britain, is only published now—a century and a quarter after the events which it relates. On this point the editor leaves us in no doubt, and the story as he tells it is an interesting bit of history, not without a touch of romance, and withal with features not altogether creditable to some of those concerned in it.

Although only returned from the first voyage in 1771, Banks accepted an invitation to join, as naturalist, Cook's second voyage, preparations for which began in 1772. This proposal called forth a strong protest from Linnæus, prophetic as things turned out of the fate awaiting the results of the first voyage. In a letter to Mr. Ellis, he says: "Whilst the whole botanical world, like myself, has been looking for the most transcendent benefits to our science, from the unrivalled exertions of your countrymen, all their matchless and truly astonishing collection, such as has never been seen before nor may ever be seen again, is to be put aside untouched, to be thrust into some corner, to become perhaps the prey of insects and of destruction." Banks eventually abandoned the intention to join the expedition, but nevertheless to it must be ascribed in the first instance the withholding from the public of his journal. Writing in 1782, Banks says: "The reason I have not published the account of my travels is that the first from want of time necessarily brought on by the many preparations for my second voyage was entrusted to Dr. Hawkesworth, and since that I have been engaged in a botanical work, which I hope soon to publish, as I have near 700 folio plates prepared; it is to give an account of all such new plants discovered in my voyage round the world, somewhat above 800." It is indeed remarkable that in course of his long life Banks did not give to the public his story of travel, but neither it nor yet the botanical work to which he refers in the above extract appeared. The death of his librarian and companion, Dr. Solander, is usually supposed to have led to the suppression of his botanical work—that for the fate of which Linnæus was so much concerned. One cannot help thinking when one regards the whole amount of the published writings of Sir

Joseph Banks, surprisingly little, as his editor points out, that whilst he was energetic in his correspondence and methodical in his records of the scientific observations he made, and always ready to help others in their work, he himself must have had a dislike to printer's proofs and preparing his papers for the press. To whatever cause we ascribe his action or inaction (and whether we shall ever know the real inwardness of the matter, seems now doubtful, owing to the dispersion of so much of his correspondence), the fact remains that "five folio books of neat manuscript, and the coppers of about 700 plates of plants rest in the hands of the British Museum Trustees"—the botanical results of the voyage of the *Endeavour;* a monument of energetic labour, skill, and knowledge, and all lost to science. The journal is at last before us.

With the death of Banks no better fate immediately awaited his journal. Robert Brown, unable to write the life of Banks as he intended, had the materials for this, including the journal, transferred to Mr. Dawson Turner, maternal grandfather of Sir Joseph Hooker, who caused a transcription to be made of the journal, but did not bring out the life. Subsequently, the task of writing the life not having been accomplished, the papers reached the British Museum, whence, however, they were claimed by the Peer, the representative of the Hugessen family, to which Banks's wife belonged, fortunately, however, not before the Dawson Turner transcript of the journal had been lodged in the Botanical Department of the Natural History Museum at South Kensington. A haggling over a price for the documents appears to have ensued between the British Museum and the Peer possessor, and in the result the whole collection of papers was sold off by auction in London, bringing in the sum of £182 19*s.*! *Noblesse oblige!* Well may Mr. Carruthers, in a letter to the editor, speak of this story as a distressing one. Sir Joseph Hooker has been able to trace the original document of the journal to Australia; but had the publication depended upon this, we should still have been in ignorance of the merits of Banks's work. Fortunately there was the transcript left in this country, which has enabled the editor to bring out the welcome volume before us. If the barque of Banks's reputation has suffered on the rocks of neglect or ignorance in the past, it is fortunate that so distinguished a pilot as the present editor—heir likewise as he was to a portion of the equipment prepared by Banks for the second voyage (p. 27, note)—has taken it in hand, placing it beyond further danger. The appearance of the journal will undoubtedly achieve the primary aims of the editor in his self-appointed task.

As a narrative the journal is full of charm. It comes before us, old as it is, with all the freshness of first impression. Familiar as much of what is told has now become through the writings of later travellers and modern facilities for globe-trotting, there is an unstrained interest attaching to scenes depicted by one who, almost in touch with the present generation, yet is able to describe Cape Town while it was still a Dutch settlement, and Mauritius was as yet the Isle of France, who sailed round New Zealand and determined it to be an island, and who tells us of people and places before all-levelling civilisation had removed the landmarks of natural evolution. The journal throughout abounds in evidences of Banks's keenness of observation and ardent devotion to scientific investigation; and whilst the bulk of it is descriptive, there are not wanting shrewd reflections and comments to show that problems of distribution and adaptation, the discussion of which gives zest to so many of the modern books of scientific travel, engaged the mind of the last-century naturalist. It is not necessary for the purpose of this notice, and it would take us too far, were we to follow with comments the narrative of the expedition; suffice it that we say the guarantee implied in the names of author and editor is not belied.

Of the adjuncts to the journal in its present guise—we have already spoken in praise of the narrative of Banks's life by the editor—there is also to be commended an admirable life of Dr. Solander, contributed by Mr. Daydon Jackson; and a series of notices of early voyagers and naturalists, compiled by Mr. Reginald Hooker, is a useful guide. Finally, excellent reproductions by photography of the portraits of Banks and Solander in the collections of the Royal and Linnean Societies, respectively, help to give attractiveness to this most delightful book of voyage.

THREE NEW BOOKS ON HISTOLOGY.

Handbuch der Gewebelehre der Menschen. Von A. Koelliker. 6te Auflage, Erster Band, pp. 409, 1889; Zweiter Band, Erste Hälfte, pp. 372, 1893; Zweiter Band, Zweite Hälfte, pp. 400, 1896. (Leipzig: Engelmann.)

Lehrbuch der Histologie der Menschen, einschliesslich der mikroskopischen Technik. Von A. Böhm und M. von Davidoff. Pp. 404. (Wiesbaden: J. Bergmann, 1895.)

Lehrbuch der vergleichenden mikroskopischen Anatomie der Wirbelthiere. Von Albert Oppel. Erster Theil, Der Magen. Pp. 543. (Jena: Fischer, 1896.)

TO place the classical treatise of the famous Würzburg professor in a list of new books on histology, must at once strike all readers who have any acquaintance with that science as manifestly absurd. Is not this the book from whose stores of knowledge our predecessors in the teaching of the subject drew so largely, and which has served ever since as the foundation upon which modern histology has been built? Is not this the book, the translation of which by Busk and Huxley, under the auspices of the Sydenham Society, rendered the names both of its author and of its translators familiar to a long past generation of students?

Whilst to these interrogatories an affirmative answer must be given, none the less is it true that the book before us is to all intents and purposes a *new* book, giving us a presentation of the most recent advances in histology, either based upon or confirmed by the careful personal work of its author, whilst still being founded upon, and an amplification of, the important works, "Mikroskopische Anatomie" and "Handbuch der Gewebelehre," the appearance of which in the early fifties at once placed their author upon the topmost pinnacle of histological science. In turning over the leaves of this edition we cannot fail to recognise many an old familiar

figure, schematised after the manner which was current in the old days, but not always on that account the less actually true as a representation of the parts which it was the business of the author to describe. And we need not complain of the continued presence of these well-worn delineations, for they not only have served, but still serve their purpose, nor do they any longer stand alone as in the old days, but side by side with them there now appear representations as true to nature as the skill of the artist and of the engraver can produce, and exhibiting the intricacies of structure of cells and tissues such as only the most modern microscopes and methods have been able to reveal.

The first volume of this edition of "Kölliker's Histology," which appeared as long ago as 1889, and is itself twenty-two years subsequent to the publication of the previous edition, deals with cell-structure, with the simple tissues, with the structure and formation of the bones, of muscles and of the integument. The second volume, consisting in all of 874 pages, is devoted entirely to the finer structure of the nervous system! From which statement, combined with the reputation of the author, it will be rightly inferred that the volume is indeed a compendious account of the structure of this, the most important, system in the body, such as has never previously been in the hands of the student. And what constitutes the most remarkable fact regarding this part of the work, is that it is an actual record of personal observations, not as with most works of the kind, mainly a *rechauffé* of the observations of other people. Needless also to add, that the methods used are of the most modern description, and that the illustrations are both clear and abundant. If Kölliker had never written anything besides this monograph of the structure of the nervous system, his reputation would have been sufficiently made. What that reputation is, with the unremitting work of sixty or more years superadded to this achievement, is known to the whole world.

The second book upon our list is one of an entirely different type, and, it may be added, of a type which we are accustomed to associate with French rather than with German authors. It gives a clear and succinct account, firstly, of the chief modern histological methods, secondly, of the structure of the cells and tissues, and thirdly, of the organs of the body, the whole being illustrated by excellent drawings, which are entirely new, and which give a stamp of originality to the work. Moreover, the reproduction of the drawings leaves little or nothing to be desired, and with the exception of one or two, which only purport to be diagrams, it will at once appear that they are on the whole extremely good representations of structure. If there is any fault to be found, it is in the somewhat meagre manner in which the central nervous system is dealt with. On the other hand, it must be admitted that to deal with this at any length, would necessarily have carried the dimensions of the book beyond what may be justly regarded as the limit of an ordinary text-book for students; which is the standard aimed at in the work before us.

The third book is one of a much more ambitious character, as the title sufficiently indicates. The aim of the author is to give a comparative account of the minute structure of every organ of the body in the whole range of Vertebrata. Since the classical work of Leydig appeared forty years ago—a work which may still be referred to by the student with manifest advantage—no adequate attempt has been made to provide a comparative account of the structure of the body, and the literature of the subject is so enormous, and the amount of material that would be required to be studied so prodigious, that no one person could by any means adequately expect to cope with it. It is but fair to say that this is recognised by the author, who, in his preface, refers to the probable necessity of the work being taken up and continued by others. The present instalment deals with the comparative anatomy of the stomach alone, in a volume of 543 royal octavo pages. Beginning with the structure of this organ in fishes, it continues with it through various amphibia, reptiles, birds and mammals, concluding with man! The book is mainly a compilation, but the fullest references are everywhere given; and therefore, although it lacks the interest which more originality would have conferred upon it (in which respect it differs conspicuously from Leydig), there can be no doubt of its value as a book of reference for all who are working either at the histology or physiology of the organ dealt with. About thirty pages are occupied alone by the titles of works referred to, and this will give some idea of the extensive literary researches which the author must have made in order to render the work as complete as it is. The illustrations are of two kinds, viz. figures on wood or zinc throughout the text, with a certain number of lithographed plates at the end of the book. Neither the author nor the publisher has spared pains to render the work excellent of its kind, and it is to be hoped that future instalments may each require far less time to produce than the seven years which the author admits that he has devoted to this present part.

It is certainly not a little remarkable that after the lapse of many years without the appearance of an important work on histology in the German language, three books, such as these, so different from one another, but all in their way important, should have appeared almost simultaneously. The fact may probably be taken as a sign of the revival of active interest in general histology, most of the interest of histologists having of late been centred upon the structure of the cell and the relations of the cells of the nervous system to one another.

E. A. SCHÄFER.

ASPECTS OF GARDENING.

A History of Gardening in England. By the Hon. Alicia Amherst. Second edition. Pp. xiv + 405. (London: Bernard Quaritch, 1896.)

UNTIL attention is specially drawn to the subject, the variety of the interest attaching to gardens and to gardening is not realised. One man estimates his garden by the amount and quality of the produce it yields for his table. Another finds his æsthetic sense satisfied by the flowers it contains. The exercise and recreation afforded by garden pursuits are keenly appreciated by yet another class; whilst to the naturalist cultivated plants are living beings, replete with all the interest begot of the study of the phenomena and functions of life.

In the garden the student may obtain a knowledge of form, structure, and affinity with greater facility than in the field or in the museum. In the garden, too, he can prosecute his experiments, even upon living things, without the chance of his objects being misinterpreted, with no fear of exciting the ire of well-intentioned sentimentalists, and no risk of being harassed by restrictive legislation.

On another side the artist has in the garden scope for the realisation of his ideas, be they in an artificial or formal direction, or in one that is, or is supposed to be, natural.

As the surroundings and conditions are so extremely varied, so there is corresponding diversity in practice. There is, in fact, ample room for differences of opinion and for diversities of taste; unfortunately, we must add for controversy, not always so amiably conducted as the nature of the subject would seem to necessitate.

Miss Amherst, in presenting to the public a history of gardening in England from the earliest times to the middle of the nineteenth century, has, with few exceptions, to which we shall hereafter refer, neglected none of these different aspects of gardening.

It does not appear from her book that she is herself a specialist in horticulture, in botany, or in landscape gardening. But that she is endowed with sympathetic intelligence, aptitude for research, and love of her subject, is evidenced throughout. Her book is well planned, well put together, and accurately, yet withal pleasantly, written. It must form for a long time the standard work on the subject.

Of course the history of gardening is in its degree the reflex of that of the period. At one time gardens were enclosed within monastery walls or castle garths. They were small in extent, and utilitarian in object. As more peaceful times came, the gardens became less restricted, both in space and in object. The utilitarian side was not neglected, but an increasing sense of security led to greater refinement and to a greater appreciation of the elegancies of life. At the same time travel became easier, and travellers more numerous. The consequence of this was that "outlandish plants" were freely introduced. Art also made its way into the garden as into other departments, and, as we have seen, it manifested itself in two opposite directions. Science found her place in the botanic gardens and in the various experiments made by the curious, experiments to which, in very large measure, we owe the profusion and excellence of the flowers and fruits of the present day. Nowadays, unless we except Orchids and some few other plants, more is done by hybridisation and cross-breeding of already introduced plants than by the importation of new and hitherto untried subjects.

The plants of to-day are largely products of the gardener's skill. There is nothing in nature precisely corresponding with the tuberous Begonias. They have originated from repeated processes of hybridisation and cross-fertilisation, and to some extent they reproduce their kind as ordinary species do. Neither Japan nor China can show in a wild state such Chrysanthemums as now excite the wonder of the spectator. They are the issue of cross-fertilisation, rigid selection, and of the suppression of some buds to the advantage of one only.

The enormous advance in commercial horticulture—in what is called market-gardening, more particularly—is hardly touched on by Miss Amherst, perhaps because she did not consider that it came within the scope she allotted to herself. It is nevertheless, so far as gardening goes, the great feature of the day, and when confronted with the depressed state of agriculture, it affords a marvellous contrast for the consideration of the economist and statesman, as well as for the historian of gardening.

GEOMORPHOLOGICAL SPECULATION.

Grundriss einer exacten Schöpfungs-Geschichte. Von Hermann Habenicht. Mit 7 Karten-Beilagen und 2 Text-Illustrationen. Pp. viii + 136. (Wien, Pest, Leipzig: A. Hartleben's Verlag.) [Preface dated 1896.]

THIS "exact history of creation" is neither so clear nor so credible as the first chapter of Genesis, with which the author tries to harmonise it, nor does it appear to come any nearer to agreement with the views of modern geologists; yet the aim of the work is distinct and noble. The preface begins:—

"This book is the fruit of nearly forty years' professional study of the known surface of the Earth and of Geophysics, chiefly from the morphological point of view, according to the best existing original works which, for the most part, were official. It is the first attempt *to refer to one single fundamental natural law*, not only the position and structure of our planet, its continents, ocean-basins, and great mountain chains, but also the conditions of the stratification of rocks, fossilisation, earthquakes and volcanoes, ice-ages, &c., even the endless profusion of the organic world and the origin of species itself. It is the first attempt to coordinate the definitely ascertained facts of Astro-, Geo-, and Experimental-Physics."

It is strange that forty years of that laborious and conscientious study, which have made the name of Habenicht illustrious in his own department of cartography, did not reveal to him even one prior attempt to simplify the bewildering history of the formation of the earth. Mankind is surely not so backward in cosmical speculation as that seems to imply. But of course these speculations do not appear in official reports; they see the light in imaginative pamphlets and books published usually at the author's risk, we fear, in more senses than the financial.

This new attempt is a republication of papers which have appeared at various dates during the last twenty years, and are now grouped to form three parts. Part i.—"Scientifically Observed Facts"—deals with the sudden appearance of new stars, the cooling of the earth experimentally considered, and the seismic problem, the last-named illustrated by a map showing the active volcanoes and axes of greatest seismic activity of the world constructed in 1889. Part ii.—"Traces of Facts from the Geological Past"—cites, amongst others, the works on the flood of Sir Henry Howorth and the late Sir Joseph Prestwich, which appear to have greatly influenced the author. Part iii.—"The Theory of the Spherical Crater-basin"—reveals the unifying law which simplifies the history of creation. It is the law of world-blisters. As the earth cooled originally, various gases extricated themselves from the fluid magma, and collected under

the crust, gradually heaving it up into a dome which burst, allowed the gases to escape, and its fragments fell back, leaving a crater-basin like those on the moon. As the crust strengthened the blisters grew larger (all Asia was required for one), and their edges were higher after the collapse. The hollows gradually filled with rain, and sediment being washed into them, gave rise to such geological forms as the Paris or the London basin. Herr Habenicht shows immense ingenuity in fitting his hypothetical blisters to the morphological lines of the earth, and the maps in the book are most interesting. If the theory were put forward as an exercise in scientific imagination, it would be clever and admirable; if it be, as we fear, a serious attempt to interpret existing geographical forms, it is valueless now De Morgan is dead, and might be mischievous. The theory is not tested; it is built to fit a certain interpretation of facts, and the demonstration that it fits that interpretation is put forward as evidence of its truth. Some concluding remarks on Darwinism and evolution are of a type once common in this country, but now becoming rare enough to make it worth while to signalise the discovery of a belated specimen. H. R. M.

OUR BOOK SHELF.

A New Speculation on the Past and Future Temperature of the Sun and Earth. By W. H. Pp. 198. (London and Manchester: John Heywood.)

YET another book designed to show men of science the imperfections in their theories, and to enlighten them as to the constitution of the universe. The main contention of the author is that the sun and earth are not cooling bodies, and that they have never formed part of the same nebulous mass. He considers that the sun is not really hot, but merely the cause of heat in sentient beings; which seems to be a distinction without a real difference. The poorness of the argument becomes even more obvious by the comparison of the molecules of the sun with the molecules of a piece of iron beaten upon an anvil. Of course we know that the molecules of the iron only have their energy increased by the blows of the hammer, and of course we know that heat *quâ* heat does not exist until it affects sentient organisms. But to argue from this that the sun is a cool body, and to say "that which we call heat in the sun is but molecular motion," is as inconclusive as would be a statement that the sun is a dark body, and that which is called sunlight is but a motion of the ether.

The author does not stop at this: he essays to prove that the sun is a hollow sphere or a system of spheres, and regards the proportions of oxygen and nitrogen in the earth's atmosphere as nicely adjusted for the comfortable existence of man; in which *post hoc ergo propter hoc* reasoning he follows the young curate who animadverted upon the beneficence of Providence in making rivers run near the towns. But enough has, perhaps, been said to reveal the character of the book. There is, however, one other little point to be mentioned. The author's chief objection is to the nebular hypothesis, but he does not appear to have got beyond that stage of astronomical knowledge when every nebula was regarded as a star cluster not yet resolved into its components. He does not think there are nebulæ anywhere in the universe, and he completely ignores spectroscopic evidence as to their existence. "Can the astronomer ever say," he remarks, "he has discovered a nebula that no power of the telescope can resolve? But suppose there was a nebula indeed, one undisputed and undisputable, what is that to me?" What indeed? all the known nebulæ and all the astronomers, will not induce "W. H." to refrain from demolishing what he regards as scientific heresies. The occupation pleases him, and it does not hurt either fact or theory. R. A.

Light. By W. T. A. Emtage, M.A. Pp. 352. With 231 illustrations. (London: Longmans, Green, and Co., 1896.)

THIS book is a new volume in the series of science manuals published by Messrs. Longmans to meet the requirements of the advanced stage of the science subjects of the Science and Art Department. It is one that should find favour with students in general, as the various parts of the subject dealt with are for the most part clearly and concisely explained. There is also no lack of illustrations, which is always a very important point in a book treating on optics, especially in the case where it may be read by students who are not all too familiar with the subject. The scope of the book will have already been gathered from the fact that it follows the Government Syllabus. We may mention, however, that the author has employed elementary mathematical treatment, having limited himself to little more than an advanced knowledge of trigonometry. Attention has been paid also to the experimental side of the subject, methods of making experiments and optical measurements being given.

To those wishing to obtain a good general insight into the principles of optics and optical instruments, the book can be recommended.

Tables for Iron Analysis. By John A. Allen. Pp. vii + 85. (New York: John Wiley and Sons. London: Chapman and Hall, Ltd., 1896.)

CHEMISTS engaged in making analyses in connection with the manufacture of iron and steel, will find these tables very serviceable. The tables are of ten classes: one set "converts a weight of a definite chemical compound obtained when a certain quantity of substance is analysed into the percentage of an element or oxide contained in the substance," and the other set "converts into one another, equivalent percentages of an element or oxide, and of a compound of which the element or oxide is a constituent." The work of technical chemists will be greatly assisted by this practical collection of conversion numbers.

Notes for Chemical Students. By Prof. Peter T. Austen, Ph.D., F.C.S. Pp. 111. (New York: John Wiley and Sons. London: Chapman and Hall, 1896.)

THERE are certain knotty points which teachers of elementary chemistry know to be difficult for students to understand, and which are not sufficiently considered in small text-books. Such are the nascent state, absolute existence of masses and molecules, smoke rings and vortex atoms, modes of chemical action, affinity, substitution, &c. This book aims at filling the gap in the literature of chemical teaching, and though on some points it is not any fuller than several elementary text-books we could name, it contains a number of clear and concise descriptions of topics which present difficulties to the student.

Notes of the Night, and other Outdoor Sketches. By Charles C. Abbott, M.D. Pp. 231. (London: Frederick Warne and Co., 1896.)

THIS series of nine essays contain the author's reflections on outdoor life and scenes in New Jersey. There are thoughts on gurgling brooks, on "swelling buds, and frogs astir in the warm waters of the throbbing springs," and similar subjects which move the spirit of poesy, and induce the mind to wander. Such lucubrations will not please the palate of students of science; for they are, as a rule, too nebulous and unsubstantial, but dreamy naturalists will be interested in them.

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.*]

Osmotic Pressure and Ionic Dissociation.

No doubt there will be great joy in the camp of the ionists over the sinner that repenteth on seeing the letter of my friend Prof. Poynting, but I imagine that those who thought that he was about to break a lance on behalf of the opponent party will agree that he is but a fickle ally, if they do not go further and conclude that he has perhaps failed to understand the real question at issue.

All are agreed that Arrhenius and van 't Hoff and their satellites have rendered inestimable service by their generalisations, and the consequent application they have made of them; certainly the world has shown its esteem of their work. Moreover, there can be no doubt, as I stated not long ago in my presidential address to the Chemical Society, that in so far as *weak solutions* are concerned a law has been discovered which is broadly true *in mathematical form*: yet I have no hesitation in asserting that the fundamental premises on which it is based are destitute of common sense in the opinion of those who look at these matters without leaving chemical experience out of account; and I venture to think that this is not only their position, but also that of many physicists. Lord Rayleigh, in fact, in the course of his remarks on Prof. Fitzgerald's Helmholtz lecture at the Chemical Society in January last, actually said:—"It is to be hoped that chemists will take into grave consideration the emphatic warning that Prof. Fitzgerald has given, particularly as to the danger of supposing that there is any dynamical similarity between the condition of a gas and that of a dissolved substance in a liquid. . . . there is possibly a risk of pushing formal analogies too far, and of supposing that there is a real dynamical similarity, whereas perhaps there is only a similarity in mathematical law."

I for one require no better support than this, and shall continue to be, as I have been from the outset, a determined opponent of what, I think, may fairly be termed the nonsensical hypothesis of ionic dissociation, for there is no other appropriate term for a view which asserts that hydrogen chloride and a few other compounds are so loosely strung together that they fall to pieces when dissolved in water: out of sheer fright, it would seem, as no valid motive is suggested for such self-sacrifice; and no such charge of unprincipled levity of conduct is brought against the vast majority of compounds other than a few acids and akalies! I believe the view in question to be in entire opposition to the teachings of chemical experience; inapplicable to the explanation of the greater number of facts. It is a sign of the times that such views can obtain the credence that has been accorded to them; proof how little we care to criticise in these days when authority counts for so much—especially in Germany. On the other hand, the facts generally seem to be in entire accordance with an association hypothesis: and if Prof. Poynting would seriously devote himself to putting such an hypothesis into mathematical form, he would be rendering the one great service that is required of physicists in this connection. All that is needed, I imagine, is to show that the equations deduced from the one hypothesis are equally compatible with another diametrically opposed to it—surely a small thing to ask of mathematicians.

The dialectical skill of those who are seeking to impose on the scientific world the ionic dissociation hypothesis as the only true faith is very remarkable. They *must* be near relatives of Maxwell's demons, judging from the adroitness with which they extricate themselves from seemingly hopeless positions—no matter at what sacrifice, and the infinite elasticity of their views—which, indeed, are often so elastic that it matters little which way the argument turns. For example, in a recent discussion on accumulators at a meeting of the German Electro-chemical Society, the possibility of lead peroxide ions existing in solution having been suggested, it was urged that the presence of a few such would not suffice: whereupon Prof. Nernst said that this was no difficulty—it was only necessary to bear in mind the readiness with which silver was separated from cyanide solutions, in which the number of silver ions was inconceivably small. If so few will suffice, why not try to do without them altogether, one is tempted to say. As another instance, I may refer to Mr. Whetham's diplomatic action in at once offering to conclude a treaty of peace with Prof. Poynting by conceding the willingness of the ions, if necessary, to bear the water molecules on their backs or be chained to them as galley-slaves: formerly we were assured that ionic dissociation was purely platonic suicide, and that there were no Rhine maidens in the stream to attract the ions apart and bear them away. Of course, in preferring these terms, the effect is carefully left out of account which such copulation would have on the mystic charges carried by the ions; hypothetical burdens which place them on a level far superior to that of any commonplace independent molecule, serving to keep them in bounds, and which permit of subtle distinctions being made between ordinary and ionic dissociation—making the latter not dissociation at all, in fact, for ionists certainly ask both to keep their cake and eat it. Again, Mr. Whetham, I note, refers to ionic velocities. To me it seems impossible to believe that the ions are the infinite sluggards indicated in conventional time-tables such as those issued under Lodgian editorship—apparently with his approval; with all due deference to such authority, we must decline to accept so slow a service, the more if we are to believe that the gaseous and liquid states are in any way dynamically comparable. It may perhaps be argued that the charges act as brakes—but surely such an argument is double-edged, for if we are to suppose that the freedom of the ions be thus clogged, liberty can scarcely be theirs to act as ordinary gaseous molecules in effecting pressure.

I am free to confess that my condition of belief as to the existence of "atomic charges" and any form of ionic *dissociation* is purely agnostic—but this is clearly an attitude which is abhorrent to those who are now arrogating to themselves the position of superior persons to whom has been granted the mission and plenary powers to reform an ancient society long steeped in superstition: to wit, the chemists. But the chemists' chief concern has been, and still is, to establish facts, and by so doing, they have probably got nearer to the inner workings of nature than any other class of investigators: for such, the new inquisition has no terrors.

In a paper, of which the Physical Society—in a most aggravating and reprehensible manner—publish but the first two pages in the current number of their journal, Prof. Larmor tells us "that the facts of chemical physics point to electrification being distributed in an atomic manner, so that an atom of electricity, say an electron, has the same claims to separate and permanent existence as an atom of matter." But is not this view based on a particular—I venture to say, a narrow—interpretation of the facts of electrolysis? Do the facts of chemistry point to such a view? Those who cultivate chemical physics have a way of putting chemistry altogether aside, as a mere unimportant detail. Does it not entirely leave out of account the difficulties which the existence of so-called molecular compounds introduces? Do physicists—do chemists even—in any way appreciate these? I have already elsewhere contended that if there be an electron, it must be capable of acting piecemeal—no discussion of the question from this point of view has yet been attempted.

The facts must not be left out of account! There are many gifted mathematicians and physicists at the present day who are showing willingness to take such matters into consideration, but they are too prone to accept their facts at second-hand—often from those who, although nominally chemists, are destitute of *chemical feeling*—an indefinable instinct which, however, has a very real existence: consequently two parties are arising with no common ground between them.

Surely there is no need to be in so great a hurry—it is no disgrace to admit that we cannot yet explain all the mysteries of the universe. Lord Kelvin told us recently that he knew no more of electric and magnetic force, or of the relation between ether, electricity and ponderable matter, or of chemical affinity, than he knew and tried to teach his students of natural philosophy fifty years ago in his first session as professor. And it should also not be forgotten that one to whom all yield respect has written: "It is extremely improbable that when we come to understand the true nature of electrolysis we shall retain in any form the theory of molecular charges, for then we shall have obtained a secure basis on which to form a true theory of electric currents, and so become independent of these provisional theories." (Clerk Maxwell, "Electricity and Magnetism.")

Meanwhile, do not let us pervert the morals of our student youth by talking glibly of atomic dissociation, and using a dogmatic phraseology which leads them to believe that we have

reached finality and gives them totally false ideas as to what *we know*. It is so easy to make use of all that is good in the new work by substituting a neutral phrase, such as coefficient of activity, for coefficient of dissociation—for all that we have really done is to recognise that certain compounds exercise a superior degree of activity, and to measure the relative degree of activity of these. To substitute for common-sense expressions which all understand—and even to promulgate at County Council expense—a set of shibboleths which commit us to a definite hypothetical interpretation of the facts is unnecessary, undesirable, and unscientific. Such metaphysical speculation is obviously doing the deepest injury to the cause of exact science.

HENRY E. ARMSTRONG.

On the Publication of Original Work.

MUCH has been written and said as to the facilities for the publication of original researches in this country. It is now becoming quite a regular custom for English comparative anatomists to publish their work in a foreign journal. Not only the morphologist, but also the systematist has found this necessary. One is naturally led to inquire why—with so many learned and wealthy societies in our midst—publication cannot be effected so as to give the author the necessary printing and illustration in a style comparable with that of continental journals, and with a minimum amount of delay?

In this country the only sources of publication for monographs on zoological subjects are the *Phil. Trans.* of the Royal Society, the *Trans. Zool.*, and the *Trans. Linn.*, and of these it would naturally be supposed that the *Trans. Zool.* is pre-eminently the place for such publications. But it will scarcely be credited that a wealthy Society like this, for some unknown reason, should allow in some cases as long as two-and-a-half years to elapse before publication of material received. Thus I find, on referring to volumes of the *Trans.*, a paper received November 1, 1892, read December 20, 1892, was published in February 1895. Another, received December 5, 1892, read February 14, 1893, was published October 1895. Still another, received October 14, 1893, read November 7, 1893, was not printed till April 1896! These are examples chosen at random.

There seems no obvious reason why any or all of these should not have been published within six months from the date of reception. A fourth instance, which I here wish to narrate, will, I trust, serve the purpose of showing zoologists the need of some more speedy means of publication.

In the winter of 1894-95, I completed a piece of work on the suprarenal capsules in fishes, and was advised to offer it to the Zoological Society for publication. The paper was received, in the first instance, on June 6, and I hoped it would have been taken as read at a meeting of the Society held in that month. It was, however, not read till November 19, when Prof. Howes was good enough to undertake it for me. It was ordered for publication in the *Trans.*, and now (November 14, 1896), nearly twelve months from the date of reading, I have not yet received my proofs. Surely such extraordinary delay as this ought not to be necessary.

During such a long period I have found it necessary to keep pace with much literature bearing upon the subject; but more than this, I have just suffered the chagrin of seeing a paper embodying a large slice of my results published by an Italian journal.

Perhaps some others will be found to agree with me that some means ought to be found of getting earlier publication in comparative anatomy and allied subjects. In the minds of many, I feel sure, there can be little doubt that the Zoological Society should undertake such work.

I do not wish to make out that I have been treated exceptionally, or in any way unjustly. My experience has been no worse than that of many others. The officers of the Zoological Society have treated me with every courtesy, and have even allowed me to publish an abstract of my paper elsewhere. But, nevertheless, I fail to see why the work could not have been published within six months from the time of reception.

SWALE VINCENT.

Mason College, Birmingham, November 14.

Cultivation of Woad.

As supplementary to the article on the cultivation of woad, by Messrs. Darwin and Meldola, in NATURE for November 12, it may further be stated that this plant has been grown besides at Parson Drove, at Boston, Wyberton, and Algarkirk, in the Lincolnshire Fenland, for a very long period. An account of its cultivation, with details of the process and preparing it for use, will be found in Arthur Young's "Agricultural Survey of Lincolnshire," published at the end of the last century. A more modern account will be found in "The History of the Fens of South Lincolnshire," recently published. This plant is not cultivated in any other part of England than the Fenland, and the total area grown altogether yearly does not, as a rule, exceed fifty acres. It requires very good land for its cultivation, and much rich old pasture land has been broken up for the purpose, for which as much as 10*l.* an acre has been paid for rent, and 150*l.* to 200*l.* for purchase of the freehold. The price obtained for woad was formerly about 25*l.* a ton, but it has declined in recent times to 9*l.* or 10*l.* The woad, when prepared for market, is not used for dyeing, but is mixed by woollen dyers with indigo to excite fermentation and fix the colour.

Boston. W. H. WHEELER.

WITH reference to your article on "An English Woad Mill," may I mention that Billingsley, in his book, published in 1798, on "Agriculture in the County of Somerset," mentions woad as an important article of cultivation, raised principally in the neighbourhood of Keynsham, near Bath. The mode of preparation, described by Billingsley as in use one hundred years ago, closely resembles the description given in NATURE as in use at the present day. He adds that the crop is a profitable one; so lucrative, indeed, that few farmers who can raise it, ever discontinue the practice. He also mentions that it was cultivated by one Harvey, more generally known as the "Woad-man," at a farm near Mells. The cultivation of woad does not appear, therefore, to have been so very rare in the last century; but whether it is still cultivated in Somersetshire, I am unable to say.

ROSA M. BARRETT.

Kingstown, Dublin, November 14.

"X-rays with a Wimshurst Machine."

THERE is an error, for which I am responsible, in my letter of July 24 (p. 31). The words kathode and anode should be interchanged in one sentence, which should then read thus:—"The same reasoning would indicate that it would be well to make the *anode* convex towards the *kathode*, and fairly small. . . ."

Eton, November 13. T. C. PORTER.

FLYING BULLETS.

QUITE recently M. Tissandier, editor of *La Nature*, received from Prof. Mach, formerly Professor of Physics at Prague, now Professor of the history and theory of inductive science at Vienna, a letter containing a photograph of a bullet in motion (Fig. 1). The photograph was taken by Prof. Mach's son, and shows most clearly the waves of air caused by the bullet's passage through the atmosphere.

M. Tissandier, wishing for an explanation of the experiment and description of the apparatus, wrote to Prof. Mach, and received the accompanying diagram (Fig. 2), with the following short account. "My son took the photographs of the bullet by using a spherical silvered-glass mirror. MM is the mirror, P the bullet, E the screen, B the photographic apparatus, S the spark. The bullet causes a sonorous wave, by which the Leyden jar is *mechanically* discharged, and produces the spark S."

It may be added that the description of his first apparatus appeared in *La Nature* of 1888.

Our readers are also familiar with the photographs of flying bullets which were exhibited at the soirée of the Royal Society in May 1892. These were results of experiments made by Mr. Vernon Boys, obtained by a modification of an old method. One slide showed the small pieces of paper scattered by the bullet passing through a sheet, and these were carried on in the same direction as the bullet itself; whereas in the case of a magazine rifle bullet going through a sheet of glass, the shattered pieces of glass appeared to travel in an opposite

direction to the bullet. Various kinds of bullets were used for these photographs, some of aluminium, in

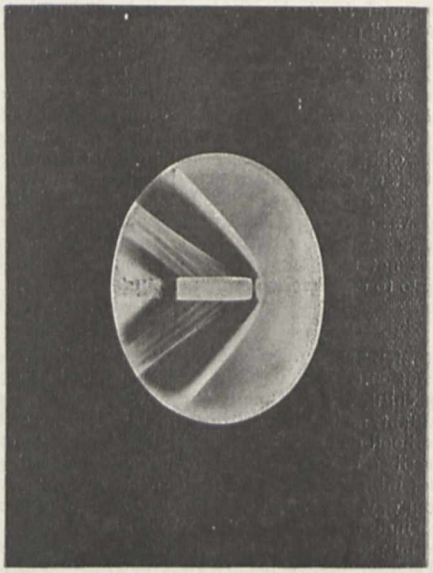

FIG. 1.—Photograph of a bullet in motion.

order to obtain a greater velocity, which varied from 750 to 3000 feet per second; the former being the

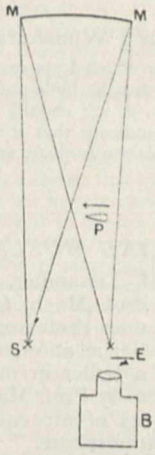

FIG. 2.—Arrangement for the photography of a bullet in motion.

average velocity of a pistol shot, the latter of a magazine rifle.

SIR B. W. RICHARDSON, F.R.S.

SIR BENJAMIN WARD RICHARDSON, whose death we regretfully announce, will be remembered more widely on account of his many lucid contributions to popular medical literature, and as an attractive lecturer on scientific subjects, than for his additions to medical knowledge. His great and versatile talents do not, however, diminish his claims to distinction as a physician of much originality of mind and a careful investigator; and these are the qualities which has earned for him the high esteem of men of science.

Sir Benjamin Richardson was born at Somerby, in the county of Leicester, in 1828, and graduated in medicine at the University of St. Andrews in 1854. After a short experience as general practitioner, he removed to London in order to devote himself to medical and physiological research. In 1856 he obtained the Astley Cooper Triennial prize of £300 for the best essay on the coagulation of the blood, and from that time forward his life was one of incessant professional and literary activity. He devoted much time to the investigation of the action of anæsthetics, and to an endeavour to discover some agent which should be superior to chloroform; but, of the many compounds with which he experimented, only one, the bichloride of methylene, has in any way held its ground, and that only in the hands of a few administrators. This inquiry led him to the discovery in connection with which his name is best known, viz. the application of ether spray for the local abolition of pain in surgical operations. Among the many other subjects which he advanced by experimental study are: the restoration of life after various forms of apparent death; methods of killing animals without the infliction of pain; effects of electricity upon animal life; and alcohol in relation to its action on man. He also introduced into medical and surgical practice many valuable preparations, among others the ethylate of sodium; and his investigations largely contributed to the attainment of a working knowledge of the properties and uses of nitrate of amyl. In 1864, "in recognition of his various contributions to science and medicine," he was presented, by six hundred members of his profession, with a testimonial consisting of a microscope by Ross and one thousand guineas.

Sir Benjamin Richardson's contributions to magazines, journals and transactions are innumerable. He originated and for a time edited the *Journal of Public Health*, afterwards called the *Social Science Review*, and for the last twelve years he has maintained a quarterly medical journal, the *Asclepiad*, of about 150 pages, every line of which has been of his own composition. On the very day of his fatal seizure he had completed the revision of the proofs of a new book entitled "Memories and Ideals." He was elected a Fellow of the Royal Society in 1867, and was the Croonian lecturer in 1873. He received the honour of knighthood in 1893, and, among other distinctions, was a Fellow of the Society of Antiquaries, of the Royal College of Physicians of London, and of the Faculty of Physicians and Surgeons of Glasgow. He was M.A., M.D., and LL.D. of St. Andrews; Fothergillian gold medallist; and past President of the Medical Society of London.

Thus for more than forty years Sir Benjamin Richardson devoted his energies to the solution of the question, "How shall pain, disease—nay, death itself as an enemy—be swept from the earth, as vanquished enemies of every race?" By his efforts to relieve pain and remove the pangs of death, and for the attention which he gave to other questions connected with his noble profession, he claims the gratitude of humanity.

Sir Benjamin Richardson leaves a widow and two sons and a daughter.

NOTES.

A MONUMENT in memory of Father Secchi, the former Director of the Collegio Romano Observatory, has been erected at Reggio (Emilia), where he was born. The sum of 78,000 francs was publicly subscribed for this purpose.

THE *British Medical Journal* states that the long-standing question of providing a statue to Darwin in his native town (Shrewsbury) has been settled by the Shropshire Horticultural Society undertaking to defray the entire cost, estimated at from £1000 to £1200.

THE death is announced of Dr. F. Saccardo, professor of natural sciences at the school of viticulture at Avellino, a recognised authority on the diseases of the vine, and a writer on lichenology.

THE competition of horseless carriages for the prizes, amounting to 1100 guineas, offered by the *Engineer*, will take place at the Crystal Palace next May. The trials were to have taken place during the past summer, but in deference to the wishes of intending competitors it was postponed until next year.

AN application of Röntgen rays to palæontology is recorded in the *British Medical Journal*. M. Lemoine, of Rheims, recently showed to the Paris Biological Society the *clichés* of Röntgen photographs of fossils embedded in the chalk strata of Rheims. M. Lemoine is reported to have thus photographed a series of fossil birds, reptiles, and mammals.

WE regret to announce the deaths of the following men of science abroad:—Dr. E. A. G. Baumann, Professor of Physiological Chemistry in the University of Freiburg; Dr. R. Kerry, Director of the Bacteriological Institute of the Agricultural Ministry at Vienna; Dr. Eugen Sell, Extraordinary Professor of Chemistry in the University of Berlin; and Dr. S. Cornelius, Titular Professor of Physics in the University of Halle.

THE sixtieth anniversary of Prof. James Hall's public services to science, as State Geologist of New York, was celebrated by a special meeting at Buffalo, during the recent assembly of the American Association for the Advancement of Science. A full report of the appreciative remarks made on that occasion by Prof. Joseph Le Conte, on behalf of the Geological Society of America, with the addresses and papers presented as tribute to the Nestor of palæontology and the founder of American Stratigraphy, appears in the issue of *Science* for November 13.

WE learn from the *Times* that Mr. David Robertson, a well-known Cumbrae naturalist, died at Millport on the 20th inst., at the age of ninety. He was a native of Glasgow, but for the last forty years he lived at Millport, and devoted much attention to the study of the natural history of the west of Scotland. In company with Dr. John Murray, of the *Challenger* expedition, he dredged the greater part of the Firth of Clyde; and largely through Dr. Robertson's efforts the foundation-stone of a permanent marine station was lately laid. Two years ago the University of Glasgow conferred on him the degree of LL.D.

WE regret to announce the sudden death of Mr. Arthur Dowsett at his residence, Castle Hill House, Reading, on Friday morning, the 6th inst. Mr. Dowsett was well known to a large circle of friends as an enthusiastic lover of natural history, and he had made large and valuable collections of ornithological and entomological specimens. He was one of the founders of the Reading Natural History Society, of which he acted as president from 1882 until the time of his death. He was scarcely ever absent from one of the Society's indoor meetings, and had greatly endeared himself to all the members by his kindly genial disposition and unfailing readiness to do anything to further their aims and objects. He was a Fellow of the Zoological and Entomological Societies.

IN his presidential address to the Royal Statistical Society, last week, Mr. John Biddulph Martin counted as enemies to statistical science the laborious compilers of figures which were of no value when obtained, and those who aimed at minute accuracy in figures when it was impossible to estimate, save approximately. The physical investigator who expresses his results to four or five places of decimals when he cannot determine one of the factors within a probable error of one per cent., comes in this category. It was through extravagances of this kind that M. Thiers defined statistics as the art of stating in precise terms things which one does not know. Dealing with the graphic method of expressing statistical totals by geometrical figures, accompanied in some cases by the employment of colours, Mr. Martin regretted that the use of the method, which had sprung up automatically, had not been developed on any conventional lines. Were the employment of particular graphic forms invariably applied to the exposition of the same phenomena, and if this conventional agreement could be made international, the interpretation of statistics graphically presented would be vastly facilitated.

IN the *Mathematical Gazette* for October, Mr. R. F. Muirhead points out that Newton's law of impact as stated in text-books does not apply to cases when three or more bodies are in simultaneous collision, and, moreover, it appears that the problem is not a determinate one unless some further assumption is made. Thus in the case of three spheres colliding together, if the collisions are not perfectly simultaneous, the final velocities of separation depend on the order in which the two first collisions take place. It would be interesting to test this last result experimentally.

SEPARATE records of the rainfall in the day and night are of much greater value to medical men than a knowledge of the mean rainfall of each month. Mr. W. W. Wagstaffe points out the advisability of keeping such records separately; and he gives, in the *Lancet*, the results of ten years' observations of the relative fall of rain in the day and night at Sevenoaks, taking the day to be from 10 a.m. to sunset. The mean annual rainfall for the day was 40 inches, and for the night 60 inches. An examination of his records shows that in winter the nights are much wetter than the days, and in spring and autumn they are also wetter, but the difference is less marked. In summer the excess of rain at night is found to be much less marked than in the other seasons.

A SHORT time ago Mr. J. H. Hart mentioned, in the *Bulletin* of miscellaneous information published at the Royal Botanic Gardens, Trinidad, that there was evidence of the attack of fungi on timber or trees previous to the destruction of the wood by Termitidæ. He returns to the subject in the October *Bulletin*, wherein he states that the mycelium of a fungus could be readily traced in all parts of the tissue of a number of specimens attacked by Termites. That it is really a fungus which attacks the wood, the experiments at Trinidad prove conclusively, and that Termites follow the attack is also clearly shown. The only doubtful point is whether the wood ants do at any time or in any case attack sound timber. So far as observations at present go, it seems that the primary cause of the destruction of wood by Termites is the mycelium of some fungus.

TO the University of Illinois belongs the honour of having established, under the direction of Prof. S. A. Forbes, the first fresh-water University Biological Station in America with an adequate equipment. The centre of operations is a commodious boat, having a laboratory in which fifteen workers can be accommodated. This floating laboratory was moored at Quiver Lake, two miles north of Havana, during the past summer. How very attractive this district is, both from a scenic point of view, and from the standpoint of the naturalist engaged in investigation, may be gathered from an illustrated article in *The Illini* of November 6. Quiver Lake is the home of myriads of water-fowl; it abounds in vegetation, and the microscopical life of the water is equally abundant and varied. It seems to be a paradise for students of natural history; so we are not surprised that the full complement of investigators occupied the boat during the months of June, July, and August, and made observations of value to biological science.

THE technical papers are almost unanimous in their adverse criticisms of the recent motor car show. *Engineering* says: "To the thoughtful engineer, last week's saturnalia could not have

been otherwise than a melancholy spectacle. . . . The proceedings only further illustrated what was pretty well known before —that at present the science of designing mechanical road carriages is in a very elementary stage, and much remains to be done before it can be claimed that a motor car has been produced fit to take its place on the highway as a commercially successful carriage, and one which can be relied upon to do general work in competition with horse-drawn vehicles." The *Electrician* remarks: "The adaption of electricity to the requirements of vehicular traffic is, in our opinion, still in the embryonic stage; and that being so, it is decidedly premature to float public companies on the basis of mere estimated profits. There is so very little to go upon, electrically speaking, and that little is so very discouraging, that no sober-minded engineer would care to countenance an appeal for funds at the present juncture, and pledge his reputation that with ordinary care the investment would, within a reasonable period, prove sufficiently renumerative to compensate for the risk run." The *Electrical Review* holds the same opinion, and shows that the scheme for using accumulator-driven cabs in London cannot be a success even with the accumulators of "special patented design" referred to by company promoters. "It behoves electrical engineers to seriously and conscientiously study the question," says our contemporary, "in hopes of some day finding the requisite and proper electric vehicle, as distinguished from the mere car of the promoting 'Juggernaut' whose pathway is strewed with the wasted gold of a confiding and credulous public."

TAILED men have again turned up. Six years ago, in the course of a visit to the Indo-Chinese region, between 11° and 12° lat. and 104° and 106° long., M. Paul d'Enjoy captured an individual of the Moï race, who had climbed a large tree to gather honey. In descending, he applied the sole of his feet to the bark; in fact, he climbed like a monkey. To the surprise of the author and his Annamite companions, their prisoner had a caudal appendage. He conversed with them, swaggered in his savage pride, and showed that he was more wily than a Mongolian, which, as the author adds, is, however, a very difficult matter. M. d'Enjoy saw the common dwelling of the tribe to which this man belonged, but the other people had fled; it consisted of a long, narrow, tunnel-like hut made of dry leaves. Several polished stones, bamboo pipes, copper bracelets and bead necklaces were found inside; these had doubtless been obtained from the Annamites of the frontier. The Moï used barbed arrows which are anointed with a black sirupy violent poison. The tail is not their only peculiarity. All the Moïs whom M. d'Enjoy has seen in the settlements have very accentuated ankle-bones, looking like the spurs of a cock. All the neighbouring nations treat them as brutes, and destroy these remarkable people, who, the author believes, to have occupied primitively the whole Indo-Chinese Peninsula. The Moï skulls described by MM. Verneau and Zaborowski were certainly by no means those of pure natives: they were taken from graves; but the settled Moï burn their dead, and place the ashes in bamboo pots, or in ratan baskets, considering their spirits as protective divinities. As this somewhat sensational account has been published by our esteemed contemporary *l'Anthropologie* Tome vii., No. 5), we must treat it with respect; and we hope it will not be long before these tailed men are carefully described by a trained scientific observer.

A VERY remarkable archæological find was made this summer near Perm, on the hilly left bank of the Kama, at the village Glyadenovo. In June last, M. Sergueeff, a member of the Perm Archives Committee, discovered at that spot traces of an earthen fort and of an extensive burial-place of the old, still problematic inhabitants of old Russia, the so-called Chuds. Systematic excavations having now been made in the five feet thick layer of bone-ashes of that burial-place, perhaps the richest known collection of Chud implements was unearthed. No less than 100 earthenware vessels, and cart-loads of broken pieces of earthenware were found. These broken pieces are ornamented with all sorts of figures, giving a full insight into the life of the inhabitants. Men sitting on horseback and in small boats, nine engravings of bees and flies, fifty-nine engravings of birds, 102 of different mammals, ten of snakes, were found on that earthenware, besides three masks and one head of mammals, one big silver plate representing a man who stands on some animal, and eight smaller silver plates, 141 bronze plates, several bronze statuettes, and an immense number of rings, stars, bells, small models of sledges, thimbles, arrow-heads, hatches, knives, 390 gilded bronze pearls, fishing hooks, skulls of stags, various carnivorous animals, &c., were discovered. In short, a full picture of the life of the Chud is given by this unique collection; the only difficulty being now to find where to house it, as the Perm "Museum" is nothing but a small apartment, hired for the exhibition of some antiquities of this extremely interesting region.

THE increasing part played by reading in the life of civilised man has resulted in the wide prevalence of myopia, astigmatism, and kindred disorders. Myopia would, however, be rare if the eye were never fatigued; so a paper by Harold Griffing and S. I. Franz, in the *Psychological Review*, on the physical conditions of fatigue in reading, and the best means of avoiding it, should be of service. From their experiments the authors conclude that the size of type is the all-important condition of visual fatigue. No type less than 1·5 mm. in height should be used, the fatigue increasing rapidly even before the size becomes as small as this. The intensity of illumination is apparently of little consequence within the limits of daylight in well-lighted rooms. Very low intensities, less than from 3 to 10 candle-metres, are sources of even greater fatigue than small type, and 100 c.m. may be considered a safe limit. White light rather than yellow light should be used for artificial illumination. The form of the type is of less importance than the thickness of the letters. White paper should be used, though it is possible that the greater amount of light reflected from pure white paper may cause some fatigue. Additional "leading" or spacing between the lines is also recommended. These conclusions should be especially known to publishers of school books.

FROM the Tōkyō Mathematico-Physical Society we have received a copy of their *Kiji* (Proceedings), including papers by Prof. D. Kikuchi, on Agima's method of finding the length of an arc of a circle, and by K. Tsuruta, on the magnetisation of iron wires traversed by electric currents. The latter paper is illustrated by diagrams showing the changes which take place in the curves of magnetisation, of susceptibility and of cyclic magnetisation when currents of different strength are passed through the wire. The author finds that the effects are the same in whatever direction the current is passed through the wire, in this respect differing from a result previously obtained by Prof. C. G. Knott.

THE revival of an old controversy in a new form, in connection with the application of corpuscular and undulatory theories to kathodic rays, has led to a rather interesting mathematical investigation by Dr. A. Garbasso, published in the *Atti dei Lincei*. The author's object was to determine whether the well-known effects of an electric or magnetic field in deflecting these rays could be accounted for on the undulatory theory, and he considers particularly the effect of a uniform magnetic field in imparting to these rays a helicoidal form. The equations obtained by Dr. Garbasso seem to show that the latter phenomenon cannot be accounted for on the hypothesis of trans-

verse vibrations, at any rate if the surfaces of equal refractive index are parallel planes. Dr. Garbasso does not seem, however, to introduce any considerations of the "Hall effect" into his calculations; whether the latter phenomenon has any bearing on the question or not, is quite another matter.

DR. E. ODDONE has recently examined the seismic record of Liguria during the last century (1796–1895), in order to determine whether the frequency of earthquakes in that district is subject to any periodic laws. The record is a non-instrumental one, and the results derived from it have not therefore the same value as those obtained from a seismometric catalogue. Dr. Oddone shows that the supposed nocturnal prevalence of earthquakes is here insensible, but there is a daily period with its maximum between 6 and 7 a.m. The two halves of the century do not exhibit the same distribution of earthquakes throughout the year, and in the latter half (during which the record is most complete), earthquakes are equally numerous in the summer and winter months. They are less frequent during years of maximum solar activity, and *vice versâ*, so that there appears to be a period of eleven years, and possibly also one of about twice this length.

WE have received a work on Earth Temperatures at Mustiala, by Dr. T. Homén, being part 9, vol. xxi. of the *Acta* of the Society of Sciences of Finland. The Agricultural Institute of Mustiala is situated in lat. 60° 49′ N., and long. 23° 47′ E.; the observations were taken both near the Institute and at the woody district of Heinäis, about seven miles to the north, during the years 1885-94, at various depths, and are printed *in extenso*, together with monthly means and yearly extremes. They are discussed with a view to showing the influence of rainfall and snow-covering upon the temperature of the earth, and are also compared with similar observations at Pavlovsk and St. Petersburg. The first regular observations of earth temperature in Finland were made at Sodankylä during the international polar expeditions of the years 1882-4; the present work, therefore, fills an important gap in the knowledge of the natural phenomena of that country, and will, no doubt, repay the large amount of careful labour bestowed upon it.

PROF. W. H. JULIUS has devised a very neat apparatus for eliminating all small movements due to vibrations from delicate instruments, such as galvanometers, &c. Last year (in the *Wied. Ann.*, 56, p. 151) he described this method, and a note on the subject was made in these columns (NATURE, vol. lii. p. 578). Quite recently he has given an account of a modified form of apparatus into which instruments to be shielded from these vibrations can be placed. This apparatus consists practically of a kind of framework, suspended by three wire cords, into which the instrument to be used is placed. It is found that, under these conditions, vibrations which otherwise would have disturbed the instrument are nearly eliminated. There are, however, certain conditions to be fulfilled to reduce such vibrations to a minimum; for instance, it is advisable so to arrange the centre of gravity of the whole apparatus, with the instrument included, that this point should fall in the plane in which the three lower extremities of the wires are connected to the framework. Further, if there be any special point in the instrument in question which must be shielded from any influence or vibration—such as, for instance, the quartz or silk thread of a galvanometer—this point should also be brought into the same plane. The apparatus which Prof. Julius has devised is arranged to fulfil these requirements. It consists of three rods placed parallel to one another in triangular form, and coupled together at their extremities by two metal hoops. This framework is suspended by three metal wires, the latter extremities of which are fixed to it at three points near their middle parts, lying in a plane between two hoops, referred to above; a third hoop is placed which can slide lengthways along the three rods. It is on this that the instrument to be freed from vibrations is placed. To bring the whole centre of gravity to a point in the plane of the three points of suspension, the framework is suspended horizontally temporarily by one of the wires; and the balance of the apparatus, with the instrument attached, is obtained by varying the position of the three weights placed near the ends of the rods for that purpose. The adjustment of that special part of the instrument which must be freed from vibration, is made by placing this, as near as possible, at the centre of gravity. To deaden any movements in the whole apparatus, three fan-shaped appendages are fixed to the hooks to which the wires are attached, and these are intended to be immersed in vessels filled with paraffin. The apparatus itself seems, from all accounts, to overcome the difficulties occasionally met in freeing delicate instruments from minute tremors. After being once accurately suspended, the chief difficulty in its adjustment is practically at an end. Supplied with the apparatus is also a small bracket, which can be fixed to the ceiling or beam, from which the apparatus can be suspended.

MR. G. C. WHIPPLE reprints from the *Technology Quarterly* (Boston, U.S.A.) an interesting paper on the growth of diatoms, especially in relation to the purity or impurity of drinking water. An abundant food supply is not the only favourable condition for the rapid increase of diatoms; temperature, the amount of light, and other conditions also influence their growth. In common with other chlorophyllaceous plants, they will not grow in the dark; while, on the other hand, bright sunlight kills them. The intensity of the light below the surface of the water being influenced by the colour of the water, diatoms are found most abundantly in light-coloured waters. Different genera, however, present differences in this respect; *Melosira* does not require so much light as *Synedra*. The weather has a marked influence on their growth. They increase most rapidly during those seasons of the year when the water is in circulation throughout the vertical. During these periods, not only is food material more abundant; the vertical currents keep the diatoms near the surface, where there is light enough to stimulate their growth, and where there is abundance of air. Some species of diatom display very strong heliotropism, moving towards the source of light.

THE two latest additions to the Encyclopédie Scientifique des Aide-Mémoire are:—"Les Accumulateurs électriques," by F. Loppé, and "L'Éclairage: Éclairage électrique," by Prof. J. Lefèvre. The volumes set forth clearly and well the principles which have their applications in those branches of electrical engineering expressed by the titles.

AT the Royal Victoria Hall on December 1, Dr. W. D. Halliburton, F.R.S., will lecture on "Painlessness," in commemoration of the jubilee of the discovery of anæsthetics; and on December 8, Dr. W. F. Hume will take "From the Crimea to Baku" as the subject of a discourse. A few months ago (vol. liv. p. 232) Dr. Hume contributed an account of the great oil region of Baku to these columns.

THE experiments of M. H. Bazin "upon the contraction of the liquid vein issuing from an orifice, and upon the distribution of the velocities within it," clearly advanced the knowledge of the important and difficult question of the liquid vein. The memoir, in which the investigation was described, has been translated by Mr. John C. Trautwine, and published by Messrs. John Wiley and Sons. Hydraulic engineers and mathematical physicists will be glad to have this authorised translation in a handy volume form.

MR. W. DOBERCK, the Director of Hongkong Observatory, has sent us a copy of his report on the work done during 1895. All the typhoons—about 250—observed since the observatory was established in 1884, have now been investigated, and Mr. Figg, in conjunction with Mr. Doberck, is at present engaged

in studying the laws of storms on the basis of these investigations. Meteorological observations are made at the Treaty Ports and transmitted to the observatory, and the hope is entertained that the number of ports from which such information is telegraphed will be greatly extended; for there is no meteorological service in China, and the data at present collected is insufficient.

THE Manchester Literary and Philosophical Society was founded so long ago as February 28, 1781, the number of original members being twenty-four. Some interest, therefore, attaches to the complete list, just issued, of the members and officers from the institution of the Society to April of this year. In the same publication are bibliographical lists of the manuscript volumes dealing with the affairs of the Society, and of the volumes of the *Memoirs* and *Proceedings* issued by the Society. There are also two appendices setting forth the original rules adopted and the objects of the meetings.

IN looking through the *Transactions* lately received from three local scientific societies, the fact is brought to mind that practically all such societies are concerned with natural history, scarcely any attention being paid to physical science. In the *Transactions* of the Leicester Literary and Philosophical Society are papers on bacteria and their importance in nature, Coleoptera of Bradgate Park, and insects in relation to the fertilisation of flowers. The Natural History *Transactions* of Northumberland, Durham, and Newcastle-upon-Tyne—the publication of the Tyne-Side Naturalists' Field Club, founded fifty years ago—contains papers on Entomostraca collected in the Solway district and at Seaton Sluice, Northumberland, during 1894, a catalogue of the spiders of Northumberland and Durham, and the results of a systematic study of pollen. In the *Transactions* of the Norfolk and Norwich Naturalists' Society are several really valuable papers. The President, Mr. H. D. Geldart, devotes his address to the consideration of the distribution of flowering plants in the Arctic regions, and strives to show that the commonly accepted hypothesis of the migration to and fro of the Arctic flora with the greater or less intensity of cold is not consistent with facts, but that plants have held their own in their old localities in spite of the intense glaciation to which they have been subjected. Mr. Geldart is also associated with Colonel Feilden in two interesting papers on Arctic Botany. Among other papers are some instructive notes on the Flora of Great Yarmouth and its neighbourhood, by Mr. G. B. Harris; and Mr. Stacy Watson contributes an account of the herring fishery from that port and Lowestoft. Some observations on the rare New Zealand Owl, *Sceloglaux albifaces*, in captivity, with a figure, are contributed by Mr. J. H. Gurney, and Prof. Newton follows with a note on an early record of the breeding of the Spoonbill in Norfolk; while Mr. Miller Christy notes a reference to an occurrence of a Narwhal in the same county in the year 1588. A list of the Mollusca of Norfolk is given by Mr. Mayfield; Mr. Preston continues his long series of Meteorological Notes for the neighbourhood of Norwich; and Mr. Southwell describes interesting recent additions to the Norwich Castle Museum.

THE *Journal of the Asiatic Society of Bengal* (vol. lxv. part 2, p. 66) contains an investigation of the decomposition of aqueous solutions of sodium hypochlorite at the temperature of boiling water, by Jyotibhushan Bhaduri. It is of interest that solutions containing from 1·5 to 1·7 per cent. of the hypochlorite, decompose less rapidly than those of any other concentration. The decomposition results in the formation not only of sodium chlorate, but also of considerable quantities of free oxygen.

IN the current number of the *Comptes rendus* M. A. Leduc gives an account of some further experiments on the densities of oxygen and nitrogen, the repetition of the determinations o the latter being necessitated by the discovery of argon. The nitrogen was prepared from four distinct sources (ammonium nitrate, ammonium nitrite, nitric oxide, and ammonia), every possible precaution being taken to ensure the purity of the gas. For the flask employed, all the weights of nitrogen found fell between 2·8467 grams and 2·8474 grams, the mean result corresponding to a relative density of 0·9671 (air = 1). The experiments with the oxygen obtained by the electrolysis of potash solution were also repeated, greater precautions being taken to remove all traces of hydrogen, while, in a second set of experiments, oxygen obtained by the action of heat upon potassium permanganate was employed, the mean relative density being 1·10523, a slight increase on the earlier results. By taking the values found for the densities of chemical and atmospheric nitrogen, together with the results of M. Schloesing, jun., on the ratio of argon to nitrogen in atmospheric nitrogen, the value 19·8 is found for the density of argon compared with hydrogen. The close agreement between this and the value found directly (19·94), affords a useful check upon the results.

THE additions to the Zoological Society's Gardens during the past week include a Sykes's Monkey (*Cercopithecus albigularis*, ♂) from West Africa, presented by Mrs. Gooding; a Squirrel Monkey (*Chrysothrix sciurea*) from Guiana, presented by Mr. James W. Wells; a White-fronted Lemur (*Lemur albifrons*) from Madagascar, presented by Mr. Richard A. Todd; a Red-bellied Squirrel (*Sciurus variegatus*) from Mexico, presented by Mr. James Meldrum; a Vulpine Phalanger (*Trichosurus vulpecula*) from Australia, presented by Mr. George Turner; two Brown Mynahs (*Acridotheres fuscus*) from India, presented by Mr. H. Nowell; a Mute Swan (*Cygnus olor*), British, presented by Mr. J. Culling; a Hawk's-billed Turtle (*Chelone imbricata*) from tropical seas, deposited.

OUR ASTRONOMICAL COLUMN.

STARS WITH PECULIAR SPECTRA.—A recent examination of some of the Draper Memorial photographs, by Mrs. Fleming, has resulted in finding some interesting cases of peculiar spectra (*Harvard College Circular*, No. 12). The spectrum of −39°3939 is described as very remarkable, and unlike any other as yet obtained. Three systems of lines cross the continuous spectrum. First the dark hydrogen lines and K, then two bright bands or lines at approximate wave-lengths 4652 and 4698. A third series has for the wave-lengths of its lines 3814, 3857, 3923, 4028, 4203, and 4505, the last being faint. These latter six lines form a rhythmical series similar to that of hydrogen, and "apparently are due to some element not yet found in other stars or on the earth." Balmer's formula was not capable of representing this series, but a modification of it gave the wave-lengths of the lines as 3812, 3858, 3928, 4031, 4199, and 4504. The only other line found in the spectrum was 4620, being apparently independent of the series just mentioned. The star R.A. (1900) 12h. 26·9m. Decl. − 57° 1′ is a new variable in Crux. Its period is about a year, and its photographic magnitude is deduced as being 10·3 at maximum, and fainter than 13·2 at minimum N.G.C. 6302 was found on July 9, 1896, to contain the bright lines characteristic of gaseous nebulæ. The stars designated +44°3649 and +44°3679 have similar spectra, containing two bright bands "resembling, and perhaps identical with, those in the spectrum of ζ Puppis." Miss Louisa D. Wells has found a new variable in Cygnus, its approximate position for 1900 being R.A. 21h. 38·8m. Decl. +43° 8′. It has a period of about forty days, and fluctuates between 7·2 and 11·2 photographic magnitudes. This range is somewhat considerable for such a short period variable.

THE LEONIDS.—From the account of the Leonid meteors given in the last number of NATURE, it would have been gathered that the shower was after all only a very ordinary one, the time of maximum being estimated as having occurred during the early part of the night of the 14th. An observer, who has written to the *Dumfries and Galloway Courier and Herald*

(November 18), seems, however, to indicate that the morning of the 15th was far richer in meteors, as the following extract indicates: "At that hour (Sunday, 3 a.m.), however, we looked out, and finding that a few stars were 'on the shoot,' began to watch for them. Till well after four o'clock there were not many visible; something like one every two or three minutes. By five o'clock they markedly increased, and from 5.15 to 5.45 there was quite a shower, and between these times we counted over sixty meteors. Once three 'came away' almost simultaneously, and another time two flashed out together. Nearly all of them were very small, and had very short and very swift flight, and many were scarcely more than just visible. There was one brilliant exception that shot out from the feet of the Twins, and disappeared near Orion's belt, that was of first magnitude, and left a red streak that remained for twelve or fifteen seconds afterwards. At six o'clock the meteors seemed almost suddenly to cease, and shortly afterwards our vigil came to an end."

M. PERROTIN, director of M. Bischoffsheim's private observatory at Nice, has resigned his post in order to become an observer at the Meudon Astro-physical Observatory.

MR. BALFOUR ON SCIENCE AND INDUSTRY.

MR. ARTHUR BALFOUR was the principal guest at the Cutlers' Feast at Sheffield last Thursday evening. In the course of his reply to the toast "Her Majesty's Ministers" he referred to scientific education in Germany, and the relations between science and manufacture. It is satisfactory to know that these subjects are now occupying the minds of our political leaders, and that such sound views should be expressed on the value of scientific research, and the true meaning of technical education, as those contained in the subjoined *Times'* report of Mr. Balfour's speech:—

"I think that, though we have not much to fear from the action of other nations, we have much to learn from the action of other nations. I have already said that I think John Bull requires the occasional stimulus of a panic to make him do his best. He is like a noble horse dragging a load, well within his weight, who perhaps gets a little slow in his action unless occasionally he hears the crack of the whip. I think that, though I do not envy the growth of German manufactures—taking Germany for example—though I neither envy the growth of German manufactures, nor fear the growth of German manufactures, though I do not think that German prosperity can be other than in the long run a help to British prosperity, still I am not so blind as to think, with regard to a nation which gives itself over with such fervour to everything which can by discipline and education promote its material prosperity, that we have nothing to learn by the study of its proceedings. I believe we have a good deal to learn, and I think it behoves us to learn it. Lord Rosebery desired that an inquiry should be made into the topics on which I am venturing to arrest your attention to-night. That inquiry is being made, or is partly being made, by the department of the Government concerned. I do not profess to give the results of these inquiries, but it is an undoubted fact that the Germans do think it, rightly or wrongly, to be worth while to spend money Imperially, municipally, and privately upon those branches of scientific research which have a direct bearing upon manufactures to an extent and degree absolutely unknown in this country, which surely ought to take the lead in all commercial matters. I have been informed by a gentleman who has recently come from an examination of these technical institutions in Germany that there are at this moment in Germany no fewer than six great technical institutions for the study of electrical matters alone, which are superior to anything of the kind which we have in this country. The witness of whom I speak was not a prejudiced witness. He went to Germany with no preconceived views either for or against the method of technical instruction there pursued, and I have faithfully detailed to you the information I gained. I am further informed, on evidence the value of which I cannot for a moment doubt, that, while the Government and the municipalities spend these vast sums in producing a great body of trained experts, the great manufacturers in Germany, to an extent altogether unknown in this country, employ a large body of investigators on their own account on their own premises, taking advantage of every discovery that can be made, and in so far as may be make discoveries for themselves. I do not comment upon the fact; I simply state the fact to you. I should be reluctant to say how great is the advantage which any country thus liberally disposed is likely to reap. It may be that the Germans have been squandering their money in unremunerative investigation, and that they will not get in the shape of national profit any result for what they have done. That may be so, but I remember the late Mr. Bagehot's pointing out that one of the great advantages that England had over every other nation in the world was this—that when any discovery was made, when any new outlet of industry was invented, the amount of disposable English capital was so great that England reaped the chief benefit from it. Now this is the question I want to put. Is not Germany, by bringing into existence this vast body of fine specialists, preparing itself to make the utmost use of any possible advances in scientific manufactures which may be made? Is it not likely that it will have the advantage, as compared with other nations, in turning to account the smallest hint in any direction, in developing any discovery however slight, in making the most of any advance, however small that advance may be? That question I put to men incomparably more qualified to answer it than I am myself."

"But I think the question is worth putting in the great manufacturing centres of this country, and I would ask them not to be put off—I do not think Sheffield is likely to be put off—but I will ask any who read my words not to be put off with the idea that what is called technical instruction, by which I mean manual instruction in arts and crafts, however good in itself, has anything to do with the particular kind of education of which I am speaking. It has nothing to do with it. Education in the first three standards of your primary schools has more to do with the higher University training than the manual education of which I speak has to do with the technical education which I desire for the country. For the education in your primary schools is, after all, a necessary preliminary of your University education. You must learn to read, you must learn to write, you must learn to do arithmetic before you can take advantage of what Oxford and Cambridge, Edinburgh and Glasgow, have to give you, but still education in the three R's leads up to all this knowledge, but the manual education called technical does not lead up to and has no relation to or connection whatever with that scientific education of which I speak. England became a great manufacturing country, the greatest manufacturing country which the world has ever seen, before the intimate relation of organised science to manufactures was thoroughly understood. I fear that in some quarters it may still be a fact that the relation between science and manufactures is not thoroughly grasped, and there may still be some who think that money spent in what appears to be abstract investigations far removed from the practical things of life has but a small effect on national well-being and national commerce. If any hold that view, believe me, they are profoundly mistaken. They have not followed the course of human knowledge, they have not kept abreast of human progress, and if we have leeway to make up in this matter, if we have to learn a lesson which perhaps came easier to the Germans than it did to us, let us hasten, at all events, to learn that lesson completely, and then I doubt not we shall—even in the eyes of the most pessimistic critic—continue to hold that position which hitherto we have held unchallenged, and then British manufactures, British industry, British capital may still maintain throughout the world the supremacy they have so long held and so well deserved."

THE LONG PERIOD WEATHER FORECASTS OF INDIA.

IN days when the *cui bono* of everything connected with scientific research is subjected to the glare of criticism by a public which is frequently too busy to analyse or understand the laborious methods by which accurate knowledge is attained, the Meteorological Service of India poses as a happy exception to that of many other scientific departments in being able to demonstrate its practical utility by the success, not merely of its every-day routine forecasts, but by its unique initiation and development of seasonal or long-period forecasts of the alternate monsoons.

The foundations so carefully laid by the late Mr. Blanford, have enabled his successor, Mr. Eliot, to realise the expectations he so hopefully expressed years ago regarding the important *rôle* that India would play in the future development of meteorology.

Beginning with a few empirical sequences first suggested by Blanford, the principles on which the seasonal forecasts, issued semi-annually from the Simla Office, are now based, are every year becoming more rational and trustworthy, and recognising the immense practical service of such a system to the country, the Government have recently sanctioned the establishment of fresh observing stations in Persia, a cable to the Seychelles, and the continuation of the monsoonal charts of the Indian Ocean, which have already thrown considerable fresh light upon the conditions which regulate the normal and abnormal development of the weather characteristics of each monsoon in different years.

The exceptional feature possessed by India, in common with most tropical countries, and which renders it possible to deal with its weather in broad masses and for long periods, instead of by the hour or day, is the fact that the periodic or climatic changes are far more important than those irregular, aperiodic, and ephemeral fluctuations which in these latitudes constitute the dominant components of weather.

Thus, to quote a single example, when all the extreme diurnal changes of pressure at principal observatories in India are tabulated for a year in groups according to magnitude, it is found that 95 per cent. of them are less than those which are due to the regular hourly oscillation ; and the same is true of similar changes in the other elements.

In brief, while daily weather anomalies and their prediction are the chief problem of the European forecaster, the relative unimportance of these in India, compared with the broad seasonal changes, or the variations of the average weather of a season from the normal (where each day resembles its predecessor so much that the effects of a certain type become cumulative, instead of being compensated by alternation), naturally leads the Indian forecaster to regard the elucidation of long-period variations, and their prediction, as the problem which should demand his principal attention.

Daily storm warnings may be of service to the shipping in the Indian ports, and round the coasts ; but for everything relating to agriculture and internal land economy, seasonal forecasts are undeniably superior.

With a good telegraphic system, daily forecasting can proceed fairly successfully on purely empirical lines, not unlike those by which a railway signaller is able to announce the arrival of an approaching train. On the other hand, successful prediction of circumstances not already in progress, and dependent upon conditions related to the movements of large air currents over extensive areas, and occupying considerable periods of time—if at first provisionally approached by empirical sequences—will ultimately necessitate as much rational inquiry, explanation and deduction as science alone can supply. India thus demands, and, fortunately, has hitherto succeeded in securing, a service of forecasters possessed of higher scientific training, as well as practical skill, than probably any weather service in the world.

The preparation of the monsoon forecasts in India is based at present on three or four broad sequences, whose rational causes are as yet only partially understood. Coupled with these are a considerable amount of deduction from rational hypothesis, comparison with present and past conditions over surrounding areas, analogy with like conditions in previous years, and modification according to ascertained persistence of local anomalies.

The determining factors may be classed as (1) local, (2) general. The local factors, which were formerly considered the most important and, indeed, the dominant causes of the monsoon, have, of late years, and especially since the publication of Indian Ocean monsoon maps, been shown to be subordinate to, and of merely secondary importance compared with, those which evidently control the strength and quality of the monsoon current itself.

For the summer, or south-west monsoon, these local factors are :—

(*a*) The snowfall of the preceding cold weather, and (*b*) the local anomalies over India and adjacent seas during the ante-monsoon months shown in the monthly average anomaly maps. At one time the former of these was thought to be the key to the problem of drought or heavy rains over the whole country during the ensuing months, scanty rains being the sequel to heavy snow. Experience, however, has shown that, while heavy snowfall over the Himalaya, especially late in the season, as in April and May, exercises an important influence in delaying the arrival, and checking the advance, of the monsoon over those areas of Upper India which border on the hills where such excessive falls have occurred, the converse is not so effective, while in any case the effects are liable to be counteracted by the intrusion over India of a monsoon current of more than ordinary strength. This latter is a circumstance which is regulated by influences connected with the circulatory system of the whole depth of atmosphere over an entire hemisphere, and, therefore, quite too large to be seriously modified by the local reactionary effects of a comparatively small snow-covered area.

Nevertheless, the reports of the winter snow-fall over the Himalaya are of considerable importance in estimating the complex probability of an early or late, favourable or unfavourable monsoon, and form one of the recognised official principles on which the final forecast is based in May.

The second factor (*b*), once thought to be all-powerful, and still of considerable importance in determining the average local and provincial variations of rainfall and weather during the prevalence of the monsoon, is estimated by the synoptic presentment of the temperature, and particularly the pressure anomalies exhibited in the monthly anomaly maps during the ante-monsoon or "hot-weather" period.

These anomalies are found to persist more or less throughout the entire period of the south-west monsoon, and indicate the lines or zones which are favoured or avoided by the cyclonic vortices which distribute the monsoon rains. As Mr. Blanford pointed out, in his classical memoir on the rainfall of India, they "rather indicate a dependence of the storm track on a quasi-persistent distribution of pressure than merely a modification of the average pressure distribution by the passage of the barometric depression accompanying the storm."

In fact they may be compared to the moulds into which molten metal is run, and which fashion its shape by guiding it into pre-existing channels and cavities.

The circumstances which determine the sudden bursting of the Indian monsoon in the first week of June, have recently been graphically described by Mr. Eliot in his paper on the character of the air movement on the Indian seas and equatorial belt during the south-west monsoon period, in the *Quarterly Journal of the Royal Meteorological Society* in January of the present year.

From a careful study of the Indian monsoon charts, and the barometric conditions over the equatorial region, it has been found that the northward advance of the sun, and the establishment of a thermal focus over the Indian land area, tends to weaken the northern side of the equatorial atmospheric crater which surrounds the ascensional terminus of the normal north and south-east trade-wind systems, and finally stop the ascensional outlet for the latter. Its consequent horizontal outflow northwards, like a pent-up lava stream, towards the newly-formed ascensional focus over the Indian land area, occurs during the last fortnight of May, in conjunction with a simultaneously sudden rise of pressure over the equator, and a consequent increase in the northward gradient.

This sudden transformation is, moreover, effected apparently more by actions tending to increase the high pressure south of the equator, due to the seasonal enlargement of the permanent south polar cyclone, than by any local actions over India or Southern Asia, though it is possible that the general conditions over the latter assist.

It is, therefore, to the South Indian oceanic area that the attention of the Indian forecasters of the monsoon is now directed, in order that they may have early intimation of the variations in the "*vis a tergo*."

As soon as the current reaches the Indian land area, it fills up the local inequalities in the pressure mould ; and since by the principle of "courtant ascendant" persistence, such local characteristics, once initiated, tend to continue, the forecaster is able to deduce, on the supposition of a normal, excessive, or weak monsoon (a distinction which can ordinarily be determined on its first appearance), the probable local deviations which form such a valuable practical part of the forecast. The results of these two local factors, together with those of a more subordinate character, are all liable to serious modification through the dominant influence of

(2) The general character and strength of the monsoon current.

It is now one of the accepted canons of Indian meteorology, which may be considered as due to the industry and perspicacity of its present high priest, that while the antecedent local anomalies over the Indian area, introduced by thermal conditions, modify the character of the current and control its local effects, they are in no sense, as was formerly believed,

its proximate cause, and that the changes in its general strength and character from year to year are more the result of actions taking place south of the equator than of any peculiar conditions over the south Asiatic land area.

The extension of the area of observation, as far as Mauritius and the Seychelles, is the logical outcome of this principle ; and though the information at present obtainable is mostly empirical in form, it is found that the essential subsequent unity of the south-east trade and the south-west monsoon enables early information of the character of the former in the southern seas to be used as an empirical index to the seasonal character of the latter as soon as continuity has been established across the equator.

A strong trade-wind argues *pari passu* a strong monsoon, and therefore a good rainy season over India, except where it is counteracted by opposing local factors.

It will probably be some time before rational knowledge of this important factor will supersede the empirical for the purposes of practical forecasting. Meanwhile every extension of the means of accelerating the transmission of news of south-east trade conditions is invaluable in forming a trustworthy seasonal forecast from the Simla Office.

The summer monsoon forecast is made up provisionally about the fourth week in May, and held over until symptoms of the coming monsoon manifest themselves in Bombay, in order to allow of the latest information being incorporated. June 6 or 7 is the average date for Bombay, and it is frequently from two to three weeks later before it reaches the Punjab.

The work of preparation is no light matter, since the greatest care is taken by Mr. Eliot to allow for every factor, and to arrive at a fair balance of probabilities.

It is a serious matter to forecast for six months over an area half as large as the United States, and the work occupies a week after every map and datum is on the table.

Two points on which the agricultural value of the monsoon rainfall largely depends are at present only partially predictable, viz. : (1) the probability of a prolonged break in the rains in July or August, and (2) the probability of an unusually early termination of the rains in Upper India or Bengal.

The former depends chiefly on the relative strength of the two branches of the monsoon current, the break generally occurring with a relatively weak Arabian Sea current, while the latter depends on the early establishment of the high pressure over North-west India and North Burmah, which causes the reversal of the gradient, and, as it were, drives the monsoon out of the Bay of Bengal.

These conditions can only be inferred months before their occurrence by analogy with previous years presenting similar characteristics.

Once they have started, however, they can be employed in determining the probability of the early or late occurrence of the rainfall of the winter monsoon.

The rainfall of this monsoon, though very inconsiderable compared with that of the summer, is, agriculturally speaking, of great value, since upon its presence the entire fortunes of the rabi crop depend.

Originating, as Mr. Eliot has so exhaustively shown in his recent "Memoir on the Winter Storms of India," in a lofty current 10,000 feet above sea-level, having no lower oceanic continuation, and shedding its vapour in storms bred on the plateaus of Afghanistan and Persia, it is at present impossible to obtain direct information of the character of the winter monsoon before its descent to the North Indian plains in December. A divining-rod has, however, been lately discovered, by which it may be inferred from the nature of the vertical pressure anomalies for the months immediately preceding December.

These anomalies represent the departure from the mean of the monthly mean pressure at stations near the foot of the hills, minus the corresponding departures at the mountain stations 7000 feet above. When the differences (plain minus hill stations) are positive, the inference is that the subsequent winter will be a dry and stormless one ; if negative, precisely the reverse.

Since the character of the winter monsoon is found to be remarkably constant all through, probably because being an upper current it is unaffected by local and land influences, the forecast from this empirical sequence alone is found to be remarkably trustworthy.

There are some additional sequences, first indicated some years ago, which are useful in confirming the conclusions derived from the vertical anomalies, such as the probability of a light winter fall succeeding a light and early departing monsoon, and *vice versâ*. Such sequences are, however, really included under a more general law which, though at present empirical in form, appears likely to lead to a rational explanation of the chief yearly variations in both monsoons. This law is the outcome of a recent discussion, by Mr. Eliot, of certain oscillatory variations of pressure which are found to be common to the entire Indian oceanic and continental areas.

It has been found that the monthly mean barometric pressure of India is subject to a series of long-period waves of nearly equal amplitude, ranging up to as much as ·07 inch (which is up to drought-producing power in India), and varying from twelve to twenty-four months in length. Twelve of these occurred in the last twenty years.

They are found to occur completely reversed in phase at Mauritius, and are considered to represent the major fluctuations in the annual oscillatory flow of air to and from the South Indian Ocean and India, in the form of the monsoons, together with similar conditions involved in the corresponding return flow in the upper and lower atmosphere, according as it is summer or winter. They are likewise precisely opposite in phase to the vertical anomalies. In other words, these oscillations of pressure represent compensatory variations in the horizontal transfer of air across the equator, and in the vertical transfers at the northern and southern termini of the circulatory system, which are intimately bound up with the strength and character of the monsoons.

The principal maxima pressures usually occur about the vernal, and the principal minima about the autumnal equinox. Employed as an empirical sequence for forecasting, the rule may be stated thus.

In years when the sea-level pressure anomaly is such that the curve is a descending slope during the spring months, the conclusion is that the south-west monsoon will be one of excessive rainfall, and *vice versâ* when the slope is ascending, it will be comparatively dry. Conversely, the years of heavy winter rainfall during the north-east monsoon, tend to coincide with the maximum epochs of these pressure anomaly waves, *i.e.* with the minimum epochs of their vertical anomaly analogues, probably because diminished pressure above coincides with increased pressure below. *Vice versâ*, years of light rainfall coincide with the epochs of general minimum anomaly at sea-level. By the accumulation of such sequences, and their gradual determination in a rational form, the science of long-period forecasting is being built up in India

The occurrence of a severe scarcity during the present year is a timely commentary on the practical value and limits of the monsoon forecast.

Of the four causes detailed by Mr. Eliot in his paper on "Droughts and Famines in India," read before the Meteorological Congress at Chicago in 1893, the present famine is due to the last—viz. "Unusually early termination of the south-west monsoon rains. This is especially fatal in the case of rice crops on unirrigated land."

The same circumstance is also peculiarly prejudicial to the sowing of the winter or "râbi" grain crop which is reaped in March, especially when it is succeeded by scanty winter rains in December and January.

As has been already observed, this early termination of the south-west monsoon is one of the conditions which, at present, lies outside the conventional forecast, though it is rapidly becoming manifest that it is dependent on the general state of the south-east trade wind of the Indian Ocean. In the Forecast Circular issued this year by Mr. Eliot, and dated Simla, June 3, attention is drawn to the fact that, during the past two or three years, the "causes of the large variations of the rainfall in India have been evidently due to abnormal conditions outside the Indian area, and not to local peculiarities or abnormal meteorological features in India itself."

The anomalies are so remarkable that they are worth reproducing, as in the following table.

Years.	Rainfall anomaly from normal over India in inches.	Percentage variation from mean.
1893 ...	+8·94	+22
1894 ...	+6·48	+16
1895 ...	−2·90	−7

The pre-monsoon conditions of temperature, pressure, and snowfall were almost identical in 1894 and 1895.

The south-east trade wind, however, was weak in 1895, and

the result was a deficient monsoon, which, moreover, terminated three weeks earlier than usual.

A similar weakness of the trades was visible, particularly at the Seychelles, this year. Hence, though Mr. Eliot was obliged to admit that the local conditions were favourable, he added a caution that "the inferences were to be accepted with greater reserve than usual."

The arena was ready for the gladiator if he arrived in good training, but the fight would depend on his strength. As events have shown, the gladiator monsoon was not "up to form," and the fight terminated a month earlier than usual all over Northern India and Burmah, with disastrous consequences to the kharif crop. It now remains to be seen whether the coming winter rains will be in defect or excess.

Until the end of the present month, when they can be inferred from the vertical anomalies of pressure, a provisional forecast can only be made on the law of sequences.

As a rule, "a light and early departing monsoon is followed by light winter rains." Consequently, so far, the outlook is serious. In such a case, however, by a similar law of sequence, the rainfall of next year's summer monsoon should be unusually heavy, so that the famine cannot continue for more than another six months. It is to be hoped that the omen may be averted, and that other factors may override the usual sequence and allow a good winter fall, which would, at all events, shorten the period of distress, and favourably modify, although it could not obviate the effects of the mischief done in September.

It would be impossible here to do more than cursorily advert to the moot question as to how far the periods of sunspot activity are directly related to the monsoons in a form in which they can be of practical utility in forecasting. *Pace* all that has been said to the contrary, there is no doubt that the condition of the sun introduces a long-period oscillation, probably of similar eleven-year period and small amplitude, into all the elements of Indian weather, modifying the epochal dates, and partially altering the character of the summer and winter rains; but year by year such a variation is too small, and too masked by others of larger amplitude, depending on changes of flow in the atmospheric currents of a less periodical and more rapid character, to admit of its entering as anything but a subordinate factor into the seasonal forecast. The attention of the department at present is so concentrated on these larger six-monthly and two-yearly oscillations, that it is unable to devote itself to the undoubtedly important task of determining the precise local value of the sunspot variation.

That this exists, however, even dominantly over the whole area, is plain from the following grouping of the yearly rainfall anomalies of the entire Indian area from 1864 to 1894, which shows that the total annual rainfall is slightly deficient about the epoch of sunspot minimum, and slightly excessive about the opposite epoch.

Groups of years.	Rainfall of India during the south-west monsoon. Anomaly from the mean smoothed figures.
Five years round year of minimum sunspot	− 0·40 in.
Five years round year of maximum sunspot	+ 2·10 ,,

The relation to the sunspots is, however, greatly modified according to locality, being especially marked during the south-west monsoon over the Carnatic and Ceylon, and occurring in a reversed phase during the winter rains of North India. Symptoms of an early arrival of the monsoon in years of maximum, and late in years of minimum, have been noted; but the general statistical examination of the question on a rational basis is still a desideratum, and one which, given the necessary additional staff, Mr. Eliot considers of sufficient importance to claim the attention of the department.

At present his view of the matter, so far as its value in practical forecasting is concerned, may be stated thus.

After all the other factors have been considered, the position of the year in the sunspot cycle may be taken as an index of the steadiness or variability of its general characteristics. Thus, in years of maximum sunspot the monsoon is distributed more evenly, and local anomalies are less exaggerated. The years about the epoch of minimum are characterised by greater local contrasts and irregularities. A comparison of anomaly ranges with sunspots would thus repay investigation, and they might yet be shown to possess a value far in excess of that indicated by the small fluctuations visible in the combined averages over dissimilar areas.

DOUGLAS ARCHIBALD.

THE NEW RESEARCH LABORATORY OF THE ROYAL COLLEGE OF PHYSICIANS OF EDINBURGH.

IN 1888 the Royal College of Physicians of Edinburgh determined to establish and equip a laboratory for original research. The scheme was regarded by the College as to a certain extent experimental, and was proceeded with cautiously. Instead of erecting special premises, an old house in Lauriston Lane was rented, close to the Royal Infirmary, and this was adapted and equipped at an outlay of 1000*l*. The success of the scheme soon became assured, and a large number of workers availed themselves of the opportunities afforded by the new laboratory for conducting investigations. The chief results of their work are set forth in five volumes of Laboratory Reports, and a sixth is now in course of preparation. A very important function of the Institution, moreover, has been the issuing of reports on morbid specimens sent to the Superintendent by practitioners. This work has gradually increased. While in 1890 only fifty reports were sent out, last year no less than 417 specimens were examined and reported on. In addition to these two primary objects of the Institution, the preparation of antitoxin serums has lately been undertaken at the instruction of the College.

The original building soon proved inadequate for the growing work of the laboratory, and the College being assured that the influence of its laboratory tended to the maintenance of the scientific spirit in medicine, directed its Committee to seek for a site on which to place a permanent institution. After many failures the College succeeded in acquiring a site and premises adapted to their wants, which has been purchased and equipped at a cost of about 10,000*l*.

The new laboratory, which was opened on November 6, is situated in Forrest Road, in the immediate vicinity of the Royal Infirmary, the University, and other medical schools.

In equipping these new premises, the objects kept in view were:—

(1) To provide a research laboratory in which bacteriological, histological, and chemical and experimental physiological and pathological work might be carried on.

(2) To make provision for examining and reporting on specimens sent by medical men.

(3) To provide a photographic department for macro- and micro-photography.

(4) To make suitable provision for carrying on the preparation of curative antitoxins, &c.

The fitting-up of the laboratory is in every respect most complete. Those portions of the building intended for laboratory work are heated by hot-water pipes, and are lighted by electricity. Hot water and steam for heating water baths are supplied throughout the building from a high-pressure-boiler; and in each department the supply of gas and water can be shut off without interfering with work in the other parts of the laboratory. Communications between the various rooms is by interchangeable telephones. To the right of the entrance is a large, well-lighted apartment, which will be used as the general office of the laboratory and for the examination of specimens. Opening off this apartment are two photographic rooms, the outer of which contains the micro-photographic apparatus and an arc lamp in a lantern, while the inner is the dark-room. On the left side of the entrance hall access is obtained to the Superintendent's room and the experimental apartment, the principal room on the ground floor, which is fitted up with the most modern apparatus and appliances for the carrying on of experimental work. In the old laboratory the recording gear was driven by water-power; in the new premises this work is done by two small electric motors placed beneath the floor. On the first flat, to the left of the landing, is the chemical room and a smaller room fitted with fume chambers. Provided with a working bench with places for six workers, the general chemical room is equipped in the most modern style. A through draught for the fume chamber is secured by a small fan driven by an electric motor. On the left of the landing, again, are large and small histological rooms and several apartments forming the bacteriological department. One of these rooms will be used for the production of the media for growing germs, and the production of diphtheria antitoxin. This department includes an incubating room.

The new laboratory, like the old, is freely open to those who desire to undertake original investigations in the medical

sciences, on their giving evidence of being able to undertake such work with a good prospect of success. Applications are considered by the Committee, who recommend to the Council, and this body grants a place in the laboratory. Apparatus, chemicals, &c., are supplied by the College free of charge, while assistance is given by the Superintendent and a staff of laboratory servants.

The examination and reporting on morbid specimens was instituted primarily for the Fellows of the College, but in a really difficult case assistance is given to any medical man who may apply. While the preparation of antitoxic serum was undertaken for the Fellows of the College, any supply beyond that required by them will be available for other members of the profession.

A REPUTED MALAGASY MONKEY.

BY far the most important zoological event of the year, so far as mammals are concerned, is the discovery in the superficial deposits of Madagascar of certain remains of an extinct monkey-like animal. Of these remains—which include the imperfect front portion of a skull, and a considerable part of the lower jaw—an illustrated preliminary notice by Dr. C. J. Forsyth Major appears in the October number of the *Geological Magazine*. And although the author of that paper may modify some of his conclusions in a later and fuller communication, the discovery is too important to be passed over without mention in this journal.

The title of the paper—"Fossil Monkeys from Madagascar"—suggests the impression that all the conclusions and theories that have been published in regard to the origin of the Malagasy fauna will have to be amended or swept away. But a study of the figures and description of the specimen will show that this by no means follows. Without entering into structural details, it may be mentioned that the skull—so far as its imperfect condition admits of forming a conclusion—conforms in general features with the Anthropoid, as distinct from the Lemuroid, type; while the molar teeth are also monkey-like. In the upper jaw the dental formula is identical with that of the Neotropical *Cebidæ*—that is to say, there are three premolars. In the lower jaw there is also a similarity between the *Cebidæ*, the number of cheek-teeth being identical. But here the resemblance ceases, for the canine is absent, and its function is discharged by the anterior premolar, which is enlarged. In this respect, as in the number of cheek-teeth, the specimen resembles the typical *Lemuridæ*; but the front teeth are different, and the premolars are unlike those of either lemurs or monkeys.

In describing the fossil—under the name of *Nesopithecus*—the author states that it indicates a distinct family of the Anthropoidea, "intermediate in some respects between the South American *Cebidæ* and the Old World *Cercopithecidæ*, besides presenting characters of its own." He adds that the following general conclusions are suggested by the discovery: "(1) We may look forward in Continental Africa likewise for the discovery of Tertiary monkeys intermediate between *Cebidæ* and *Cercopithecidæ*. (2) The recent African *Cercopithecidæ* are not invaders from the north-east, as has been supposed; on the contrary, most, if not all, of the Tertiary monkeys of Europe and Asia are derived from the Ethiopian region. The home of a part, at least, of the Anthropoidea seems to have been in the southern hemisphere. This assumption is corroborated by the two facts—that Anthropoidea make their appearance suddenly for the first time in the later Tertiary of Europe and Asia, and that they are entirely absent from the Tertiary of North America."

To properly criticise these conclusions would require much more space than is allowed by the editor. It may be conceded, in the first place, that the specimen undoubtedly indicates a distinct family; whether, however, it is an Anthropoid, appears much more doubtful. The presence of a functional lower canine is so constant in that group, that I think it may be taken as a subordinal character. And in any case the functional disappearance of that tooth indicates that *Nesopithecus* is not an ancestral type of the existing Anthropoids. Whether the transference of the functions of the canine to the anterior premolar indicates any affinity with the Lemuroids, or is merely a case of parallelism, I am not prepared to say. But it does seem probable that the fossil is an offshoot from the original stock which connected the monkeys with the lemurs. And, so far as it goes, it tends to discountenance the view that the *Cebidæ* are not genetically connected with the old-world monkeys.

With regard to the other conclusions of Dr. Major, I believe there is good evidence of the occurrence of fossil monkeys in the French Phosphorites (although this has never been published); and it hence appears probable that the ancestors of *Nesopithecus* may have reached Ethiopia with the other progenitors of the Malagasy fauna. I would further hazard the suggestion that the ancestral South American *Cebidæ* likewise reached Ethiopia at the same time, and that they migrated to South America in the manner I have suggested in my recent volume on the Geography of Mammals for the Santa Crucian Ungulates. The supposition of Dr. Major that "most, if not all, of the Tertiary monkeys of Europe and Asia are derived from the Ethiopian region," does not appear to have sufficient evidence for its support. And if it were admitted, we should have to account for the absence of true monkeys in Madagascar. Probably the *Cercopithecidæ* and *Simiidæ* reached Ethiopia with its antelopes and zebras. Hence there seems no reason, at present, for modifying our conclusions as to the origin of the Malagasy fauna.

As it is a somewhat important matter, I may take this opportunity of asking—should this meet his eye—the German Professor who some years ago showed me at the British Museum some monkey-like molar teeth from the French Phosphorites, if he would either describe his specimens or communicate with me.

R. LYDEKKER.

MICROSCOPIC MARINE ORGANISMS IN THE SERVICE OF HYDROGRAPHY.

IT has for a long time been known that the sea abounds in microscopic organisms, both animal and vegetable. Among the former are entomostraca, infusoria, radiolarians, foraminifera, as well as larvæ of mollusca, radiates, and bryozoa. Among the plant-life the mass consists of diatoms, cilioflagellates, flagellates, and certain unicellular chlorophyllaceous algæ. For these pelagic forms Prof. Hensen has proposed the name *plankton*, which has been universally accepted.

Some years ago I examined the samples of vegetable plankton collected by the Swedish Arctic expeditions, as well as samples from various parts of the tropical seas, and I became convinced that certain parts of the oceans are characterised by different species. In the year 1893 I spent the summer at the west coast of Sweden, where I had the opportunity of examining the plankton at the marine biological station of Christineberg, that is to say in a fjord (loch) called Gullmarsfjord. I found that in the month of June the plankton consisted mainly of cilioflagellates, *Ceratium tripos* being the most common. During the last days of the month, however, the plankton changed. The water was from that time very rich in entomostraca, and the cilioflagellates became less abundant. At the same time the mackerel appeared in the fjord. All my samples had been collected at the mouth of the fjord, where the water is not very deep. In the interior the fjord becomes deeper, as is the case also with the Scotch lochs, and I now wished to know the character of the plankton at different depths. What I hitherto had examined was the plankton of the current, called by the Swedish hydrographers the Baltic current, which in the spring and summer runs along the Scandinavian coast up to Bergen, in Norway. Below that surface current there exists, according to the Swedish hydrographers, water with lower temperature and greater salinity. In company with Prof. G. Théel, and with the aid of his net, which could be closed and opened below the water, I made in July an attempt to get plankton from different depths of the fjord. We found in the cold bottom water very little plankton, some few specimens of a large *Sagitta* and of *Calanus finmarchicus* only. At about 30–40 metres the cilioflagellates (among them *Ceratium divergens*) were abundant, and on the surface the entomostraca. This examination was repeated during the first days of August, when I and Dr. Aurivillius had the opportunity of accompanying Prof. S. A. Pettersson and Mr. G. Ekman on the hydrographical expedition which went out at the time. The result was the same as before, but from the determination of the temperature and the salinity of the water it became clear that the plankton had been collected in water differing in those

respects, and consequently that the different strata of water were characterised by different amounts of plankton, and by different species. Samples of plankton were afterwards collected by the Swedish hydrographical expeditions, at the same time as samples of water for physical and chemical research. The examination of the plankton was carried out by Dr. Aurivillius, who took charge of the animal plankton, and by myself, who undertook the vegetable.

Having examined a large number of samples, I have lately found that the plankton of the Skagerack and Kattegat can be classed according to the prevailing species, and in this way I distinguished four types, namely: (1) *Tripos-plankton*, (2) *Didymus-plankton*, (3) *Tricho-plankton*, and (4) *Sira-plankton*.

(1) The *Tripos-plankton* is characterised by its scarcity in diatoms and its abundance in cilioflagellates and entomostraca, which give to the spirit, in which the samples are preserved, an orange or yellow colour, all the other kinds of plankton colouring it more or less deep green. Among the entomostraca, according to the publications of Dr. Aurivillius, *Paracalanus parvus*, *Pseudocalanus elongatus*, and *Evadne spinifera* are the most abundant. Among the cilioflagellates *Ceratium tripos*, with the variety *macroceros*, is the most common. *C. divergens*, *C. furca*, and *C. fusus* occur in less numbers. Diatoms are, as I have said, scarce, the most abundant being *Coscinodiscus concinnus* and *Rhizosolenia gracillima*. In winter and early spring the unicellular alga, *Halosphæra viridis* is found in abundance. This kind of plankton characterises the water of the Baltic current, and prevails in the summer in the Kattegat and Skagerack. The organisms consist chiefly of euryheline and eurythismic species, which can withstand the dilution of the salter North Sea water by the slightly saline Baltic water.

It seems very probable that this first type of plankton may by future researches be split up into different kinds. We may thus, perhaps, distinguish one kind, characterised by *Halosphæra viridis*, and occurring in the winter, another by *Rhizosolenia gracillima*, occurring in the summer, one with *Paracalanus parvus*, and another with *Pseudocalanus elongatus*, and so on.

In all cases it seems to be certain that the water containing this first type is derived from the North Sea as well as from the Baltic.

(2) The *Didymus-plankton* consists principally of diatoms, among which the most characteristic species are *Chætoceros curvisetus*, *Ch. didymus*, *Ditylum Brightwellii*, *Rhizosolenia alata*, and *gracillima* (the latter probably a residuum of Type 1), *Skeletonema costatum* and *Thalassiothrix Frauenfeldii* (the latter probably common to Type 3). A silicoflagellate, *Dictyocha speculum*, occurs constantly, but not abundantly. The cilioflagellates, as well as the entomostraca, are scarce.

This kind of plankton was predominant in the Skagerack and Kattegat in November 1893, filling the fjords from the bottom to the surface. With the water, containing this kind of plankton, the herring arrived on the shores of Scandinavia. It seems to have been a very large bulk of water that at this time set in to the coast, as it drove away the whole of the summer water from bottom to surface.

The diatoms of this type are not known from the Arctic Ocean or from the Northern Atlantic, but are well known from the coasts of France and Belgium and the English Channel. It seems thus to be beyond doubt that the water came from the southern North Sea, along the western coast of Denmark. The temperature, as well as the salinity, were found to be variable, but the plankton constant. In the Gullmarsfjord the water at the surface had a temperature of 7° C., at a depth of 30 m. nearly 12°, and at the bottom only 4° to 5°. The salinity amounted respectively to about 26–27, 32 and 33 to 37 per thousand. This variation may be explained by the mixture of the water of the second type with the water previously present in the Kattegat. Probably the warmest water was the most pure water of Type 2, and corresponds to one of the kinds of water called by the Swedish hydrographers the *bank-water*.

(3) The third type of plankton, the *Tricho-plankton*, is distinguished by its diatoms, especially the following species:—*Thalassiosira longissima*, *Rhizosolenia styliformis*, *Chætoceros atlanticus* (in a less degree also by *Ch. borealis* and its variety *Brightwellii*), and *Biddulphia mobilensis*. The first-named species occur abundantly and almost pure in the Northern Atlantic, south of Iceland; the last-named I observed at Plymouth, West Scotland, and in the North Sea. This plankton may thus be considered a Northern Atlantic plankton. At the Scandinavian coast it seems to occur very rarely in a pure state; in fact I have seen it only once, in February of this year, gathered at the bottom of the Christiana fjord (100 m.), where the temperature amounted to 7·5° C., and the salinity to 34·76 per thousand, the highest figures obtained by the hydrographical examinations of all the samples gathered in February 1896.

On the other hand, this plankton was frequently found mixed with the next type in samples collected at the time named.

(4) The fourth type, the *Sira-plankton*, consists also mainly of diatoms, but of different species, the most characteristic being *Thalassiosira Nordenskiöldii*, and *Th. gravida*, *Chætoceros grænlandicus*, *Ch. socialis*, *Ch. scolopendra*, *Ch. teres*, *Nitschia seriata*, many of which belong to the Arctic seas, and some of which are new to science. Among the cilioflagellates the most abundant is a variety *arctica* of *Ceratium tripos*, distinguished by Dr. Aurivillius as a constituent of the plankton of Baffin's Bay.

There can be no doubt about the Arctic origin of this type. It occurred in the Skagerack and Kattegat this year in February and March, always more or less mixed with (3) and (1). In the Skagerack the water with Types (3) and (4) was covered by a shallow layer of water with Type (1); but in the Kattegat it reached the surface. The admixture of Type (3) shows that the water on or before its arrival at the coast of Sweden was mixed with Atlantic water. The temperature and the salinity were found to vary greatly, owing to the admixture of the slightly saline Baltic water, at this time of the year very cold.

I have observed the same type of water in some slides collected on the west coast of Scotland by Mr. George Murray, and sent to me by Mr. Grove. These samples had been gathered in the spring of 1888—a year remarkable in England as an unusually cold one.

As far as the plankton researches are advanced at present, we may conclude that the surface water around the Swedish coast consists in the summer of water from the North Sea mixed with Baltic water; that in the autumn its place is taken by water from the southern part of the North Sea, and in the winter by water from the Northern Atlantic and the Arctic Ocean. Whether these changes occur regularly every year, or in certain years only, cannot be answered for the moment. Probably the last change is in correspondence, as Prof. Pettersson has recently suggested, with variations in the amount of water which the Gulf Stream carries past Iceland, westwards to Davis Strait and eastwards to the Arctic Ocean.

I think I have proved by the above that the examination of plankton is a matter of the greatest interest, not only in relation to hydrography, but also to meteorology and to fishery questions. There can be no doubt about the close connection between the state of the sea and the movements of the air, and the still obscure causes of the migration of fishes may be found to be intimately connected with the change of water containing different kinds of plankton.

It is thus an important matter that the plankton of the North Sea should be thoroughly and systematically examined; but for this, international co-operation of all the nations around the North Sea is required. I imagine that a central station, under the direction of competent persons, and provided with adequate accommodation, might be erected. Samples could be collected at certain intervals, and by the same kind of apparatus at different stations, and sent to the central one for examination. The details should be published every month, and the general results formulated in a way that would be useful to hydrographers, meteorologists, &c. The marine biological stations already in existence will probably be found willing for co-operation in such an undertaking, but they will be able to collect plankton only near the shores or at short distances from them. For getting samples from the open seas, the officers of the steamers crossing the North Sea and the Northern Atlantic might be found willing to assist, as the plankton may, as Dr. John Murray hinted to me, be procured by pumping water into a silk net. I recently tried this method whilst crossing from Edinburgh to Göttenburg. I fastened the net to the pump when the deck was being washed, and in this way I obtained sufficient plankton to prove that in the last days of July the North Sea was almost free from diatoms, and its plankton consisted mainly of cilioflagellates and entomostraca.

P. T. CLEVE.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—The Professor of Anthropology (Dr. E. B. Tylor) delivered a public lecture on Monday, November 23, at the Museum, on "North American Picture-Writing, with special reference to a Series of Historical Wampum-Belts of the Hurons."

The second meeting of the Junior Scientific Club for this term was held on November 18, and was very largely attended. Prof. Gotch performed an experiment showing the effect of a current induced in a nerve, insulated in air, by a Wimshurst electrical machine. Prof. Ray Lankester exhibited and described (1) a series of casts of the jaws and teeth of Ornithorhynchus, and of fossil mammalia from the Stonesfield slate; (2) a specimen of Triarthrus presented by Prof. O. C. Marsh; (3) a number of species of Leptocephali. In connection with the last, Prof. Lankester gave an account of the development of the eel as determined by Grassi. Lord Berkeley read a paper on "The Necessity of Metaphysics in Science," which was followed by a prolonged discussion.

CAMBRIDGE.—Mr. T. L. Heath, editor of Diophantus and Apollonius, has been approved for the degree of Doctor of Science.

The Council of the Senate propose to present a memorial to the Lord President of the Privy Council communicating the resolutions of the recent Conference on Secondary Education, and urging the importance of early legislation on the subject.

Mr. J. B. Lightfoot has generously presented to the engineering laboratory a refrigerating machine and ice-making apparatus especially adapted for experimental purposes.

Prof. Ewing, Prof. J. Perry, and Mr. J. B. Peace have been appointed examiners in mechanical science.

Mr. W. M. Fletcher and Mr. E. B. H. Wade have been elected Coutts Trotter students in experimental physics at Trinity College.

A BRILLIANT assembly met in the amphitheatre of the new Sorbonne on Thursday last, the occasion being the inauguration of the newly-constituted University of Paris. From the *Times'* report we learn that the magnificent hall was filled with a distinguished company, including the President of the Republic, the Prime Minister and his colleagues and the Presidents of the two Houses, the Academicians, the resplendent Diplomatic Corps, all the public bodies, the entire faculty of the Paris University in their robes, and some 5000 or 6000 students. The bodies hitherto forming part of the University of France, which now constitute the University of Paris, are the faculties of Letters, Sciences, Law, Medicine, and Protestant Theology. Without reckoning the 41 chairs of the Collège de France, which retains an independent position, the University has 116 professors, besides lecturers, laboratory directors, and experimentalists.

THE Report of the U.S. Commissioner of Education for the year ending June 30, 1894, consists of two volumes, each of more than one thousand pages. The mass of information thus brought together refers to schools of all grades and in all countries; but limits of space will only permit us to mention a few of the matters dealt with. The report of the "Committee of ten," appointed by the National Educational Association to inquire into the courses of study and conditions of secondary schools, was summarised in these columns a short time ago (vol. liv. p. 308). Another Committee, composed of fifteen members, was appointed to investigate, in a like manner, the work of elementary schools, and their report is included in one of the volumes before us. The Committee discussed in detail the several branches of study that have found a place in the curriculum of the elementary school, with a view to discover their educational value for developing and training the faculties of the mind. Language is given the first place, the opinion being that, in the form of reading, penmanship, and grammar, it should be prominent in the first eight years of study. Arithmetic is given the second place in importance of all studies, because it or mathematical study furnishes the first scientific key to the existence of bodies and their various motions. Mathematics in its pure form, as arithmetic, algebra, geometry, and the application of the analytical method, as well as mathematics applied to matter and force, or statics and dynamics, furnishes the peculiar study that gives the command of the quantitative aspect of nature. It is held that the study of arithmetic should begin with the second school year and end with the close of the sixth year, the seventh and eighth years being devoted to algebraical methods. Following arithmetic as the second study in importance among the branches that correlate man to nature is geography. This is, therefore, given the next place. The next study ranked in order of value by the Committee is history, after which come other branches, among which is science. It is held that "Natural science claims a place in the elementary school not so much as a disciplinary study, side by side with grammar, arithmetic, and history, as a training in habits of observation and in the use of the technique by which such sciences are expounded." Other matters of scientific interest dealt with in the report are forestry education in France; geology in the colleges and universities of the United States; rules for the spelling and pronunciation of chemical terms; rise and progress of manual training; American learned and educational societies, and criminology.

THE current number of the *Revue Générale des Sciences* contains a paper by M. Cornu, the President of the Académie des Sciences, on the objects of the instruction in the École Polytechnique, and on the principles which ought to decide the courses of instruction therein. In view of the multitudinous discussions in this country on the general questions of the co-ordination of the teaching in schools of different grades and of the prevention of overlapping, this paper is of exceptional interest. The general conclusions at which M. Cornu arrives are as follows. (We must refer our readers to the *Revue* for the arguments which lead up to them.) The object of the school is to give young men destined for the public services that theoretical knowledge which is necessary to enable them to perform their duties with confidence, and to qualify them to help towards the perfection of these services. What is termed *la Mechanique rationnelle* is the foundation of this polytechnic instruction. Students ought to be competent, at the end of their studies, to solve any problem which they may be called upon to deal with in their future careers of engineers and officers. Considering the limited number of years of study and the impossibility of any great development in the interesting subsidiary branches of science, the instruction in other sciences—such as analysis, physics, astronomy—ought to be arranged in such a manner as to assist in the completion and illustration of this course of mechanics. The list of acquirements demanded on admission ought to form a homogeneous whole, without either adventitious additions or serious omissions, capable of immediate application, and, as far as possible, easy of later completion, either by the courses of this school, or of the places of higher instruction, or even by the efforts of the students individually. The experience of old students and their teachers has shown that those subjects studied during the years preparatory to admission leave the most lasting impression on the minds of the students. The courses of the school leave a profound impression, it is true, but to a less degree than this preparatory work. Finally, since the preparatory instruction to the polytechnic school exercises this decisive influence on the minds of the students, it ought to be directed with a view to giving results which would form an intellectual equipment sufficient to serve during the whole career of the student. These results ought to be established by simple and general methods, and to be presented under a definite form on the same lines as those which will be used later. Not only should all useless refinements be carefully avoided, but even subjects which are not in immediate harmony with the general trend of polytechnic instruction.

SCIENTIFIC SERIALS.

American Journal of Science, November.—Missourite, a new leucite rock from the Highwood Mountains of Montana, by W. H. Weed and L. V. Pirsson. This new rock type forms a stock of granular rock intrusion in cretaceous shales, and in the fragmental volcanic material which overlies them, both being highly altered near the contact with the igneous mass. It is dark grey, coarsely and evenly granular, and on closer inspection presents a mottled appearance. The minerals present are apatite, iron ore, olivine, augite, biotite, leucite, and some zeolitic products. This is the first granular volcanic rock in which leucite has been found.—Viscosity of mixtures of liquids, by C. E. Linebarger. The viscosities found by Ostwald's method are all less than those calculated by the rule of mixtures, except in certain mixtures of benzene and chloro-

form, and of benzene and carbon bisulphide. In the latter the differences are very slight, and these liquids may be said to preserve their viscosities without appreciable change. But when the constituent liquids have very different viscosities, such as benzene and nitro-benzene, the resultant viscosity is lowered considerably.—Volume measurement of an air thermometer bulb, by W. G. Cady. This may be accomplished without filling the bulb with water or mercury, by connecting it with a short graduated tube, changing the volume of the combination by an amount indicated on the graduations, and measuring the increase of pressure.—Residual viscosity and thermal expansion, by H. D. Day. A bar of vulcanised rubber expanded until 50° was reached, and then suddenly contracted. On again heating after some time, it expanded till it reached the highest temperature at which it had been maintained beforehand, and then contracted again. This phenomenon is due to internal strain in its manufactured state, and to a consequent molecular settling which sets in at certain temperatures.—Application of certain organic acids to the estimation of vanadium, by P. E. Browning and R. J. Goodman. Describes the determination of vanadium by means of tartaric, oxalic, or citric acid in the presence of molybdenum and tungsten.—Determination of oxygen in air and in aqueous solutions, by D. A. Kreider. A known volume of air is conducted through a strong solution of hydriodic acid in the presence of nitric oxide; the acid is neutralised by potassium bicarbonate; and the liberated iodine is titrated with standard decinormal arsenic solution, from which the equivalent volume of oxygen is readily calculated.—Amphibian footprints from the Devonian, by O. C. Marsh. A genuine specimen of a footprint from some vertebrate animal, apparently amphibian, has been found in the Upper Devonian of Pleasant, Warren County, Pennsylvania. This is the first evidence of life superior to the fishes found in that formation. The specimen is preserved in the Yale Museum.

Wiedemann's Annalen der Physik und Chemie, No. 11.—Rotations in a constant electric field, by G. Quincke. Rods, plates, spheres, or cylinders of a dielectric substance, suspended in a liquid dielectric between vertical condenser plates, exhibit slow rotations about an axis parallel or at right angles to the lines of force when a constant field of sufficient intensity is maintained between the plates. The author describes a great variety of experiments which exhibit this curious phenomenon. He explains it by the electrostatic deformation of the air film adhering to the bodies and producing a tangential pressure.—Photo-electric residual action of kathode rays, by J. Elster and H. Geitel. Alkaline chlorides exposed to the action of kathode rays assume peculiar colorations, and become photo-electrically sensitive. At the same time their phosphorescence diminishes, and a bluish film resembling an alkali metal is deposited on the walls of the tube. The authors naturally supposed that this consisted of metallic sodium, potassium, cæsium, or rubidium due to decomposition of their respective salts by the kathode rays. This would account for the observed photo-electric behaviour. But mercury was incapable of forming an amalgam with the deposit, and this explanation is therefore excluded. That it must be sought in a modification of the salt itself is shown by the fact of the photo-electric property remaining in the open air as long as the colour remains. Similar properties are possessed by colourless fluorspar, by potassium carbonate and glass, and to a slighter extent by calcium and barium chlorides. The authors think that a slight reduction takes place, and that the metal produced forms a solid solution in the remainder of the salt.—Interference refractometer for electric waves, by O. Wiedeburg. Describes an arrangement corresponding to Jamin's refractometer adapted to electric waves. The refractive index of paraffin found by this method is 1·418, and of plate glass 2·63, with a probable error of only 1 per cent.—Helmholtz's absolute electro-dynamometer and its use in determining the E.M.F. of a Clark cell, by K. Kahle. The electro-dynamometer consists of a square metallic band acting upon a coil attached to the arm of a balance, the planes of the band and the coil being perpendicular to each other. The square shape has the advantage that only its corners need support, and the band allows of strong currents and simplifies calculation. The E.M.F. of the H-shaped Clark cell was found to be 1·4488 volts at 0° and 1·4322 at 15°.—The cadmium standard cell, by W. Jaeger and R. Wachsmuth. A Clark cell of the H-shape, in which cadmium amalgam is substituted for the zinc amalgam and cadmium sulphate for zinc sulphate has an E.M.F. of 1·019 volts at 20°. It has an extremely small temperature coefficient (0·004 per cent., instead of 0·1 per cent. as in the Clark cell), and it is not surpassed by the ordinary Clark cell as regards durability and facility of reproduction.—Influence of Röntgen rays upon the steam jet, by F. Richarz. Since X-rays make air temporarily conducting, and therefore probably lead to ionic dissociation, they would also on that account increase the condensation in a steam jet. This is actually the case, as the author showed by exposing a steam jet, screened from direct electrostatic action, to the rays traversing an aluminium window.—Aluminium amalgam, by V. Biernacki. This may easily be obtained by dipping an aluminium wire repeatedly into mercury, while each metal is connected with a pole of a battery. It may be kept for a long time in perfectly dry air, but in moist air it oxidises rapidly, forming a growth of pure alumina which makes an attractive lecture experiment.

THE latest issue of the *Izvestia* of the East Siberian branch of the Russian Geographical Society (vol. xxvi., Nos. 4 and 5, Irkutsk, 1896) contains various matters of interest. It begins by an elaborate paper, by A. A. Kaufmann, on the complex forms of land tenure in Siberia. An immense mass of data relative to this question has lately been accumulated by the surveys and explorations which have been made in Siberia, in order to ascertain the area of land which remains free for the new-coming settlers, and the results of these elaborate researches and surveys were embodied in a series of volumes, published by the Ministry of State domains, under the name of "Materials relative to the economical conditions of the peasants in Siberia." M. Kaufmann now sums up the results of these researches, which are the more important as they show what forms of land tenure have been developed by the immigrants themselves, who had been left absolutely free to occupy immense tracts of waste land, and to work out such forms of land tenure as they themselves found convenient. A very great variety of forms of land tenure has thus come into existence in both West and East Siberia, nearly all hitherto known forms of land tenure being represented on this vast area, with the exception of only one, namely the private, hereditary and individual ownership of the land. This last does not exist, while communal possession is everywhere the rule, and it takes a quite unsuspected variety of forms. The prevailing form is the possession by a group of villages, or by the canton or Volost, which includes from ten to fifteen separate villages, and usually has several thousands of inhabitants, who consider the land of the Volost as their common possession, and allot and re-allot it according to their respective needs. Within the estate of the Volost, again, a great variety of forms of land tenure is found, and very often strangers to the canton are also admitted to the temporary possession of parts of the Volost's estate in exchange for similar rights being granted to the inhabitants of the Volost on the land owned by those strangers. On the whole, M. Kaufmann's essay can be earnestly recommended to the attention of the students of the subject in this country.—Two papers, on the Buryates of Irkutsk, by P. E. Kulakoff, and on the Buryates of Transbaikalia, by M. A. Kroll, are full of interest, as the former contains valuable remarks on the influence of the Shamanist religion, the epidemical insanity which lately prevailed in the Buryate settlements, the influence of contact with the Russians, &c.; while the second has new data upon the tribal organisation, and mentions the interesting fact that the Transbaikalia Buryates do not die out as other natives do, but have doubled their numbers since the beginning of this century.—Three papers, on the Yakutes, deal with the old tribal organisation of the Yakutes, with some graves of the beginning of this century, and with the Yakute tales collected by the late M. Khudyakoff, and lately published at Irkutsk under the name of "Verkhoyanskiy Sbornik."—V. B. Shostakovich contributes a paper on the protective adaptations of the buds in different Siberian trees and bushes (with one plate); and Prof. Katanoff gives an account of the Turkish inscriptions on the Orkhon and the Yenisei.

SOCIETIES AND ACADEMIES.

LONDON.

Chemical Society, November 5.—Mr. A. G. Vernon Harcourt, President, in the chair.—The following papers were read:—The constitution of the so-called nitrogen iodide, by F. D. Chattaway. The most probable formula assignable to

nitrogen iodide is NH_3I_2; it is decomposed by excess of water, giving iodine and ammonium iodide and hypoiodite. The author has examined its reactions.—The carbohydrates of barley straw, by C. F. Cross, E. J. Bevan, and C. Smith. Evidence is adduced which points to the gradual transformation in barley straw, of a hexose into a pentose derivative; a transition form of the constitution $C_5H_8O_3\begin{matrix}O\\ \diagup\diagdown\\ O\end{matrix}CH_2$ appears to exist.—The direct union of carbon and hydrogen, by W. A. Bone and D. S. Jerdan. Much acetylene and some methane are found in dry hydrogen gas in which an electric arc has burnt between carbon poles.—The explosion of acetylene with less than its own volume of oxygen, by W. A. Bone and J. C. Cain.—The refraction constants of crystalline salts, by W. J. Pope. The molecular refractions of crystalline salts, calculated from the several principal refractive indices, is an additive property.—Compounds of metallic hydroxides with iodine, by T. Rettie.—Economical preparation of hydroxylamine sulphate, by E. Divers and T. Haga. Sodium nitrite, sulphonated with sodium sulphite and hydrolysed, yields nearly its own weight of hydroxylamine sulphate.—The reduction of nitrososulphates, by E. Divers and T. Haga. Potassium nitrososulphate, when reduced with sodium amalgam, yields hyponitrite, sulphite, sulphate, amidosulphonate, nitrous oxide, hydrazine, ammonia and nitrogen.—Imidosulphonates, Part ii., by E. Divers and T. Haga.—Amidosulphonic acid, by E. Divers and T. Haga. An economical method of preparing this acid is given, and its properties and reactions are described.—Molecular conductivity of amidosulphonic acid, by J. Sakurai.—The physiological action of amidosulphonic acid, by O. Loew. The salts of this acid seem poisonous only to phænogamous plants, and not to other forms of vegetable or to animal life.—How mercurous and mercuric salts change into each other, by S. Hada.—The effect of heat on aqueous solutions of chrome alum, by Miss M. D. Dougal. Experiments on the diffusion of violet and green chrome alum solutions harmonise with the view that the green solutions contain sulphuric acid and a colloïdal chromylsulphuric acid.—On the hydrolysis of ethylic dicarboxylglutaconate, by H. W. Bolam.—The periodic law, by R. M. Deeley.—The colouring matters occurring in various British plants, by A. G. Perkin and J. J. Hummel. The colouring matter of the yellow wallflower (*Cheiranthus cheiri*) consists of quercitin and a new substance, isorhamnetin, $C_{16}H_{12}O_7$; the colouring matter of white hawthorn blossoms (*Crætagus oxycantha*) is quercitin.—Position-isomerism and optical activity; the comparative rotatory powers of the dibenzoyl- and ditoluyl-tartrates, by P. Frankland and F. M. Wharton.—Researches on the terpenes. VII. Halogen derivates of camphor, by J. E. Marsh and J. H. Gardner. Bromine and phosphorous trichloride convert camphor into two isomeric tribromocamphene hydrobromides, $C_{10}H_{14}Br_4$; they are both convertible into the same tribromocamphene, $C_{10}H_{13}Br_3$. A number of bromo- and chloro-camphene derivatives have been obtained.—Derivatives of camphenesulphonic acids, by A. Lapworth and F. S. Kipping.—Preparation of dimethylketohexamethylene and experiments on the synthesis of dimethylhexamethenylmalonic acid, by F. S. Kipping and W. B. Edwards.—Sulphocamphylic acid, $C_9H_{14}SO_5$, with remarks on the constitution of camphoric acid and of camphoronic acid, by W. H. Perkin, jun. The further study of the decomposition products of α- and β-camphylic acids leads to results which can be explained on the assumption that camphoric acid has the constitution $\begin{matrix}CMe_2\cdot CH_2\cdot CH_2\\ |\qquad\quad |\\ CMe(COOH)CH\cdot COOH\end{matrix}$; this view supports Bredt's formula for camphoronic acid.—On Pettenkofer's method for determining carbonic anhydride in air, by Prof. Letts and R. F. Blake. By employing precautions suggested by the authors, Pettenkofer's method can be made of great accuracy and delicacy.

Geological Society, November 4.—Dr. Henry Hicks, F.R.S., President, in the chair.—The President referred to the loss which the Society had sustained by the decease of Prof. A. H. Green, F.R.S., who had served for some years on the Council, and was Vice-President at the time of his death.—The President announced that Lady Prestwich, in fulfilment of the terms of a bequest of her late husband, had offered to the Society 260 bound volumes of geological tracts from his library. Also that a sum of £800 had been bequeathed to the Society by Sir Joseph Prestwich, the interest to be applied to the triennial award of a medal and fund: this bequest to take effect subsequent to the decease of Lady Prestwich.—Additional note on the sections near the summit of the Furka Pass (Switzerland), by Prof. T. G. Bonney, F.R.S. The author, during a visit to Switzerland in 1895, had taken the opportunity of completing the examination of the sections on the western side of the Furka Pass, and of glancing again at those previously studied. His observations support the view that the white, sometimes slightly quartzose or micaceous, marble which crosses the summit of the Pass is a rock much older than the Mesozoic era. Dr. J. W. Gregory thought that Prof. Bonney's maintenance of his former conclusion after a third study of the relations of the saccharoidal and the Jurassic limestones would lessen the value attached to the difficulties of his theory. Neither explanation is free from difficulty, but the constant differences now found between the two rocks greatly increase the probabilities in favour of the fault-theory. In reply the author said they must either assume very peculiar faulting or very sporadic and inexplicable metamorphism—seeing that the marble was totally different from the adjacent Jurassic rocks, was exactly like the marbles elsewhere members of the crystalline schists, and evidently had been affected by pressure after it had become a marble, while the other was simply a limestone affected by pressure. Hence he thought that the hypothesis of faults offered the fewer difficulties.—Geological and petrographical studies of the Sudbury Nickel District (Canada), by Dr. T. L. Walker. Sudbury is a small town situated in Northern Ontario, in the centre of the nickel-mining district. North of the Great Lakes granite and gneiss form almost boundless terranes, interrupted only by belts of Huronian rocks, which are in turn associated with post-Huronian eruptives, the most important of which are the large nickel-bearing massives. The nickel-bearing rocks, which are eruptive, form long elliptical stocks which conform to the strike of the Huronian rocks containing them. Contact-action indicates that they are younger than the rocks previously referred to. The smaller eruptives are composed of greenstone, which appears to have been formed from norite or gabbro. Some of the larger eruptives, however, have been highly differentiated on cooling, as they are now composed of granite and greenstone with gradual transitions from the one to the other. The greenstone generally forms one side of the eruptive, and on the outer border is often characterised by large masses of nickeliferous pyrrhotite, chalcopyrite, and nickeliferous pyrite, with frequent smaller masses of magnetic iron ore rich in titanic acid. The author regarded these mineral masses as genetically related to the greenstone and granite, in that they appear to be the extreme products of differentiation. About half the world's nickel supply is drawn from these deposits.—On the distribution in space of the accessory shocks of the great Japanese earthquake of 1891, by Dr. Charles Davison. The object of the author in this paper is to consider the geographical distribution of the numerous shocks which preceded and followed the great earthquake of 1891. Reasons were given for believing that the distribution of earthquakes in 1890–91 was little, if at all, due to the marked shock of May 12, 1889, but that the earthquakes of these years were preparatory to the great earthquake, the consequent relief at numerous and widely distributed points equalising the effective strain along the whole fault-system, and so clearing the way for one or more almost instantaneous slips along its entire length. This outlining of the fault-system points to the previous existence of the faults, and implies that the great earthquake was due not to the rupturing of the strata, but probably to the intense friction called into action by the sudden displacement. The distribution of the after-shocks was then discussed, and it was maintained that the after-shocks of the Mino-Owari earthquake for the first fourteen months were subject to the following conditions: decline of frequency, decrease in the area of seismic action, and a gradual but oscillating withdrawal of that action to a more or less central district. Prof. Milne said that the Mino-Owari earthquake had furnished a greater number and a more varied series of seismic phenomena for analysis than had been noted in connection with any disturbance previously recorded. When this earthquake took place an enormous fault, which can be traced over a length of more than forty miles, appeared upon the surface, and it was usually supposed that the sudden rupture and displacement of vast masses of material along this line were the cause of the earthquake. On account of a peculiar distribution of shocks which took place prior to 1891, Dr.

Davison argued that the fault or faults in the Mino-Owari district were outlined before the occurrence of the great earthquake, which was, therefore, only the result of their extension. This may have been so, but it must be remembered that before 1891 the number of shocks occurring in the Mino-Owari plain were not numerous; and as from 1889 to 1891 it cannot be said that they increased in number, while their distribution, as exhibited by maps, was largely dependent upon the observing-stations. Where the maps showed blank spaces, in many cases the country was mountainous, and there were no observers.

Linnean Society, November 5.—Dr. Günther, F.R.S., President, in the chair.—Dr. Morris, C.M.G., Royal Gardens, Kew, exhibited specimens and slides illustrating the occurrence of raphides in the bulbs of the common hyacinth of gardens (*Hyacinthus orientalis* and varieties). Forms of eczema were said to have been produced in persons handling and cleaning these bulbs. Although the fact was familiar to gardeners, the cause did not appear to have been clearly traced. Experiments and observations at the Jodrell Laboratory at Kew had shown that both dry and moist scales were capable of producing considerable irritation in certain cases when applied directly to the skin. There was little doubt that the raphides were the prime agents. These needle-shaped crystals (composed of oxalate of lime) varied from $\frac{1}{100}$th to $\frac{1}{200}$th of an inch in length, and were arranged in close bundles, easily dispersed by rubbing the dry scales. In the growing plants they were doubtless protective, as snails, for instance, avoided hyacinth bulbs, but attacked others growing close by. Roman hyacinths (var. *albulus*) were understood to cause greater irritation than other varieties. Dr. D. H. Scott described some experiments which he had tried, tending to confirm the conclusion that the irritation of the skin produced by contact with the bulb-scales of Hyacinths is due immediately to puncture by the numerous raphides.—On behalf of Dr. H. B. Hewetson, of Leeds, Mr. Harting exhibited photographs of a specimen of Macqueen's Bustard (*Otis Macqueeni*) which had been shot at Easington, in Holderness, on October 17 last, and gave a brief account of the species, which had now been met with in England for the third time; the first instance of its occurrence having been noticed in Lincolnshire in October 1847, and the second in Yorkshire in October 1892.—Mr. Hugh Warrand exhibited a remarkable bird which was believed at first to be a hybrid between the Red Grouse and Ptarmigan, but which in the opinion of Mr. Ogilvie Grant, Mr. Millais, and Mr. Harting, could only be regarded as an abnormally pale-coloured grouse. Only one possible instance had been recorded of such a hybrid as was suggested, viz. in the case of a bird which was exhibited some years ago by Prof. Newton to the Zoological Society (*P. Z. S.*, 1878, p. 793) and had since been figured by Mr. Millais in his work on Game Birds. A specimen of the Cream-coloured Courser (*Cursorius isabellinus*), an extremely rare visitor to this country from North Africa (probably *viâ* Spain), which had been shot on Salisbury Plain, at Earlstoke, on October 10 last, was exhibited by Mr. Harting, who gave particulars of the occurrence, and stated that another example of this bird had since been obtained in Bouley Bay, Jersey.—A paper by Mr. A. W. Waters, on Mediterranean Bryozoa was then read. Dealing in the first place with some *Cellulariidæ* and other Bryozoa from Rapallo, the paper was to some extent a revision of work already published on Mediterranean Bryozoa. Stress was laid upon the importance of noting the position from which the radicle-tube grows, and this was found to be a character of specific value.—Dr. S. Schönland communicated a paper on some new species of *Crassula* from South Africa, which he had obtained from localities which had been very rarely visited by botanical collectors, and which were believed to be undescribed. Mr. J. G. Baker, who criticised the paper, spoke in favourable terms of the care which had been taken by the author in its preparation, and thought there was sufficient justification for describing the species mentioned as new.—A revisionary monograph of the New Zealand Holothurians, by Prof. A. Dendy, of Christchurch, N.Z., was read.—The Rev. J. Whitmee made some remarks on the Trepang fishery in Samoa, where several edible species of Holothurians are gathered and prepared for the market, and called attention to the well-known fact that a small fish of the genus *Fierasfer* used the body of the Holothurian as a habitation.

Mathematical Society, November 12.—Major MacMahon, R.A., F.R.S., President, in the chair.—The President briefly stated the grounds of the award by the Council of the De Morgan medal to Mr. S. Roberts, F.R.S.; and after receiving the medal, Mr. Roberts thanked the Council and the members for the honour they had conferred upon him, and said that his connection with the Society had been of great service to him.—The ballot was then taken, with the result that the gentlemen whose names are given in NATURE for October 22, were declared to be duly elected to form the Council for the ensuing session.—Prof. Elliott, F.R.S., having taken the chair, called upon Major MacMahon to read his address, which was on "The Combinatory Analysis." Mr. S. Roberts gave, in abstract, an account of Herr E. Lasker's "Essay on the Geometrical Calculus, Part 1." The titles only of the following papers were read, owing to the lateness of the hour:—"Symbolic Logic," H. MacColl; "On a General Integral with some physical applications," G. J. Hurst; "On Ratio," Prof. M. J. M. Hill, F.R.S.; "On the Geometrical Construction of Models of Cubic Surfaces," W. H. Blythe; "Theory of Vortex Rings," H. S. Carslaw; "Differentiation of Spherical Harmonics," E. G. Gallop; "On the Application of Jacobi's Dynamical Method to the General Problem of Three Bodies," and "On certain properties of the mean motions and the secular accelerations of the principal arguments used in the Lunar Theory," Prof. E. W. Brown; "Note on the Symmetric Group," Prof. W. Burnside, F.R.S.; "Note on the Capacity of a Conductor in the form of two intersecting spheres," W. D. Niven, F.R.S.

CAMBRIDGE.

Philosophical Society, October 26.—Prof. Hughes, Vice-President, in the chair.—The following elections were made:—President: Mr. F. Darwin. Vice-Presidents: Prof. G. D. Liveing, Prof. Newton, Prof. J. J. Thomson. Treasurer: Mr. Glazebrook. Secretaries: Mr. Newall, Mr. Bateson, Mr. Baker. Ordinary Members of Council: Dr. Gaskell, Mr. Marr, Mr. Larmor, Dr. Marshall Ward, Mr. Shipley.—Mr. F. Darwin, President, then took the chair.—Mr. S. F. Harmer exhibited the casts of *Iguanodon bernissartensis*, Boulenger, recently presented to the Museum of Zoology by H.M. the King of the Belgians. The casts are reproductions of some of the famous specimens preserved in the "Musée Royal d'Histoire Naturelle de Belgique," at Brussels. These specimens were discovered in April 1878, in the colliery of Bernissart, a village situated between Mons and Tournai, close to the French frontier. The bones, which are of Wealden age, were found at a depth of 356 metres (322 metres below sea-level). Nearly thirty complete skeletons, belonging to full-grown individuals, were found at the time of the original discovery, or at a later period; the great majority belonging to *I. bernissartensis*, and the others to *I. mantelli*, well known in England through the labours of Mantell, Owen and others. Although much had been done in England and elsewhere, towards understanding the structure of *Iguanodon*, no skeleton which was more than fragmentary had been described before the Belgian discoveries were made. Prof. Newton stated that the importance attached by many high authorities to the group of Dinosaurs known as *Ornithopoda*, from their resemblance in several points to the class *Aves*, had long made him desirous of obtaining for the Museum of Zoology a cast of one of the famous Belgian *Iguanodon* skeletons. About a year ago he mentioned the subject to the High Steward of the University, who, with his accustomed kindness and energy, at once asked Her Majesty's Minister at Brussels to find out on what terms the want could be supplied. In due time an answer was received by Lord Walsingham that this could be done by the University paying for the cast or offering in exchange specimens to the value of 200*l*. Meanwhile the subject had been also mentioned to the late Lord Lilford, who had for many years been so great a benefactor to the museum, and he at once addressed the late Rev. Horace Waller, well known as a companion of Livingstone. Mr. Waller suggested an application to King Leopold himself, through his personal friend Sir John Kirk. To this Sir John readily consented, and, on His Majesty visiting London last winter, made known to him how acceptable the gift of a cast would be. The King was graciously pleased to entertain the application favourably, and gave orders accordingly, with the result that after a short correspondence with M. Dupont, the Director of the Museum at Brussels, not a single cast only, but the magnificent series now exhibited arrived in the course of the summer, and owing to the royal donation having liberally included the necessary ironwork, the skeleton was mounted without difficulty. Though the thanks of the Senate have been most properly offered to H.M. the King of the Belgians for his

great munificence, and this token of his good will, the gratitude of all here is equally due to Sir John Kirk, without whose kind and ready intervention, the University would have been unable to procure this desirable acquisition.—Remarks on the structure and affinities of *Iguanodon*, by Mr. H. Gadow. Though birds are descendants of some reptilian stock, it was held that the particular group of ancestral reptiles is not to be found among the Iguanodonta, not even among the much wider group of Dinosauri, in spite of the close resemblance of the pelvis and most parts of the hind-limbs with the corresponding organs in birds. The composition of the skull, the formation of the fore-limbs, and the palæontological evidence absolutely forbid such an intimate connection with birds. Bipedalism, upright gait, is a feature which has been acquired independently and at various geological epochs by the most heterogeneous creatures, for instance by kangaroos, jerboas, birds, iguanodonts, and even by chlamydosaurus, the peculiar frilled lizard of Queensland.—Notes on cyclostomatous polyzoa, by Mr. S. F. Harmer.

DUBLIN.

Royal Irish Academy, November 9.—The Earl of Rosse, President, in the chair.—Dr. R. F. Scharff read a paper on the origin of the European fauna. In a previous paper he had dwelt on the importance of, in the first place, ascertaining the facts relating to the origin of the fauna of a small area, such as that of Great Britain or Ireland. If that of Great Britain be closely examined, its fauna will be found to consist of three elements, viz. northern, southern, and eastern. There is also a mass of evidence to prove that this latter element reached England after the others, and this is strengthened by the fact that the eastern fauna, which in many respects corresponds with the so-called Teutonic flora, is absent from Ireland. If the geological date of the arrival of this eastern, or, as it might be called, Siberian fauna into England, could be even approximately ascertained, the period of the migration of the southern and northern faunas could also be fixed as taking place at an earlier period, while the separation of Ireland would have occurred at a time intermediate between these events. Dr. Scharff showed that not only was the lower continental boulder clay an undoubtedly marine deposit, but that the eastern or Siberian migration-forms all occur in inter-glacial or later deposits, overlying the boulder clay. The very earliest members of that migration arrived in England during the deposition of the forest bed, so that the newest English, so-called, pliocene crags would therefore be contemporaneous with the lower continental boulder clay. The faunistic evidence proved that the land connection between Ireland, Scotland and Scandinavia, existed until a much later period, and that the Arctic marine fauna which is found in the newer English crags came direct from the Arctic Ocean across the plains of Northern Europe. At that period it was suggested that the Arctic Ocean was completely separated from the Atlantic Ocean. To enable the mammoth to cross from Asia, with other large mammals, the American and Asiatic continents must have been connected at Behring's Straits, whilst another mass of land stretched from Arctic America by way of Greenland and Spitzbergen to northern Scandinavia. The Arctic Ocean swept over Russia and Northern Germany, as far as the east coast of Great Britain. The climatic conditions of European land as then existing were peculiar; while the west coasts of the British Islands and Scandinavia were bathed by the waters of the Gulf Stream, the eastern shores of these countries were lashed by the waters of the Arctic Ocean. There therefore existed the necessary conditions for an excessive snowfall and consequent glaciation on the territories between the two oceans, without requiring any very extreme lowering of the temperature in Northern Europe—viz. evaporation of the warm waters from the Gulf Stream, and the condensation of these vapours on their coming into contact with the cold air from the Arctic Sea.—A paper on the melting point of some minerals, being work done in the Physical Laboratory of Trinity College, Dublin, by Mr. Ralph Cusack, was communicated by Prof. G. F. Fitz-Gerald, F.R.S.—Sir Robert Ball, F.R.S., communicated a memoir, being the eleventh, on the theory of screws, entitled "Further development of the relations between impulsive screws and instantaneous screws."—Several recently-published parts of the thirtieth volume of *Transactions* were laid on the table.

PARIS.

Academy of Sciences, November 16.—M. A. Cornu in the chair.—The Perpetual Secretary announced to the Academy the loss it had sustained by the death of M. H. Gyldén, of Stockholm, Correspondent in the Astronomical Section.—Notice on the work of M. Hugo Gyldén, by M. O. Callandreau.—Researches on phosphoric acid; estimation of pyrophosphoric acid, by MM. Berthelot and G. André. The pyrophosphoric acid is precipitated as magnesium pyrophosphate in presence of an excess of acetic acid, by a mixture of magnesium chloride, ammonium chloride, and ammonium acetate. Test analyses are given showing the accuracy obtainable by this method.—Transformations of pyrophosphoric acid, by MM. Berthelot and André. The acid was prepared by the action of an aqueous solution of hydrogen sulphide upon the lead salt. The aqueous acid is very slowly converted into orthophosphoric acid, 87 per cent. remaining unchanged after five days' standing, 43 per cent. after 121 days, no metaphosphoric acid being formed. The velocity of transformation is greater the more concentrated the solution.—On the earths of the yttrium group contained in the monazite sands, by MM. P. Schutzenberger and Boudouard. Two methods have been tried for the separation of these earths, the fractional crystallisation of the sulphates from the hot aqueous solutions, and the partial decomposition of the nitrates. All attempts at separation by the first method proved ineffectual, but the fractional decomposition of the nitrates by heat gave better results, fractions being obtained with atomic weights varying between 92 and 148. Only one spectrum, however, that of yttria, was given by all the fractions.—Determination of the positions of Santa Cruz, Teneriffe, Saint Louis (Senegal), and Dakar; measurement of the acceleration due to gravity, by M. Bouquet de la Grye.—Memoirs on some problems in navigation and on magnetic observations at sea, by M. Guyou.—On an extension which may be given to a theorem by Poisson, relating to the invariability of the axes, by M. H. Andoyer.—On the convergence of uniform substitutions, by M. E. M. Léméray.—On surfaces of lines of isometric curvature, by M. T. Craig.—Some problems in rigid mechanics, by M. René de Saussure.—On the permanent changes of glass, and the displacement of the zero points of thermometers, by M. L. Marchis. With a view of studying the laws regulating the changes of zero in mercury-glass thermometers, a glass was purposely chosen that should make these changes as large as possible. The experiments were conducted at temperatures between −60° C. and 357° C.—Influence of magnetisation upon the electromotive force of a thermo-couple, of which iron is one of the elements, by MM. U. Lala and A. Fournier. A diminution of the electromotive force was observed to take place when the couple was placed in a strong magnetic field.—The absolute measurement of small thicknesses, by MM. Ch. Fabry and A. Perot.—On the densities of nitrogen, oxygen, and argon, and the composition of atmospheric air, by M. A. Leduc (see p. 84).—On a law relating to water vapour, by M. Rateau.—On a new tap for use with compressed gas-cylinders. This tap is so constructed as to allow rapid filling during compression, but to prevent the rapid exit of the gas. It is especially suitable for use with liquefied acetylene.—The neutrality of salts with reference to coloured indicators, by M. H. Lescœur. The blueing of litmus, or reddening of phenol-phthalein, is regarded as indicating not the change from acidity to alkalinity, but from neutrality to alkalinity. With methyl orange, on the contrary, the change to yellow indicates the change from acidity to neutrality. A salt would, from this point of view, be defined as neutral if methyl orange and phenol-phthalein remained colourless, and litmus remained red. Under this definition, such salts as alum and zinc sulphate would be neutral.—Action of sulphuric acid and iodine upon iodic acid. Practically pure iodic anhydride in crystals can be obtained by recrystallising the crude substance from concentrated sulphuric acid to which a little fuming nitric acid has been added.—Analysis of air by *Agaricus atramentarius*, by M. T. L. Phipson. The absorption of oxygen from a confined volume of air by this fungus appears to be as complete as with phosphorus.—On some properties of pure glucina, by M. P. Lebeau. Glucina melted in the electric furnace has its density practically unchanged. The oxide is not reduced by heating with magnesium, sodium, potassium, or aluminium, but boron, silicon, and carbon can reduce it with the formation of crystalline compounds.—On an iodide of molybdenum, by M. Guichard. By the action of hydrogen iodide upon the chloride $MoCl_5$, the iodide MoI_2 can be prepared in the amorphous state.—On the separation of tungsten and titanium, by M. Ed. Defacqz.—The spectrum of chlorophyll, by M. A. Étard. The conclusion is drawn that several distinct green colouring matters have been described under the name of chlorophyll.—On the fixation of

atmospheric nitrogen by the association of algæ and bacteria, by M. Raoul Bouilhac.—The organic material of the mineral water from Tulle-Haut, by M. F. Garrigou. The residue from thirty litres of this mineral water gave reactions indicating the presence of an alkaloidal substance.—On the distribution of lipase in the organism, by M. Hanriot. Various parts of the body were examined, but lipase was only found in notable quantity in the serum, pancreas, and liver.—The achromatometer, by M. A. M. Bloch. An instrument to measure the pressure necessary to decolourise and render bloodless a limited portion of tissue. It differs from previous instruments of the same class in that its use is not limited to the horizontal position.—On the parasitism of the *Monstrillidæ*, by M. A. Giard. The *Monstrillidæ* offer the first example of a parasitic crustacean.—Researches on the morphology of *Trichomonas intestinalis*, by M. J. Kunstler.—Ravages caused in Algeria by the caterpillars of *Sesamia nonagrioides* (Lefevre) to maize, sugar-cane, and other plants, by M. J. Kunckel d'Herculais. Observations on the habits, and on the best means of combating this pest.—On the pool of Berre, and pools situated in its neighbourhood, on the coast of Provence, by M. André Delebecque.—On the subterranean streams near Vercors (Drôme), by MM. E. A. Martel and A. Delebecque.—Relations between lunar movements and barometric movements on the northern hemisphere, by M. A. Poincaré.—Extraordinary rains: the pink rain at Croisic (Loire-Inférieure) of November 8, 1896.

DIARY OF SOCIETIES.

THURSDAY, NOVEMBER 26.

ROYAL SOCIETY, at 4.30.—Mathematical Contributions to the Theory of Evolution. On Telegony in Man, &c.: Prof. Karl Pearson, F.R.S., and Miss Alice Lee.—On the Magnetic Permeability of Liquid Oxygen and Liquid Air: Prof. Fleming, F.R.S., and Prof. Dewar, F.R.S.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—The Telephone Trunk Line System in Great Britain: J. Gavey. (Continuation of Discussion.)

SOUTH LONDON ENTOMOLOGICAL AND NATURAL HISTORY SOCIETY, at 8.—Exhibition of Varieties in all Orders.

FRIDAY, NOVEMBER 27.

PHYSICAL SOCIETY, at 5.—Apparatus for giving Diagrams of the Efficiency of a Photographic Shutter: Captain Abney, F.R.S.

MONDAY, NOVEMBER 30.

SOCIETY OF ARTS, at 8.—The Use of Gas for Domestic Lighting: Prof. Vivian B. Lewes. (Three Lectures.)

INSTITUTE OF ACTUARIES, at 7.—Inaugural Address by the President, T. E. Young.

TUESDAY, DECEMBER 1.

ZOOLOGICAL SOCIETY, at 8.30.—On the General Results of his Zoological Expedition to Madagascar: Dr. Forsyth Major.—Notes on a Collection of Reptiles and Batrachians made in the Malay Peninsula, with a List of the Species hitherto recorded from that Region: Stanley S. Flower.—Description of New Fishes from the Upper Shiré River, British Central Africa, collected by Dr. Percy Rendall, and presented to the British Museum by Sir Harry H. Johnston, K.C.B.: G. A. Boulenger, F.R.S.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Paper to be further discussed: The Bacterial Purification of Water: Percy F. Frankland, F.R.S.

WEDNESDAY, DECEMBER 2.

SOCIETY OF ARTS, at 8.—The Teaching of Economics: W. A. S. Hewins.

GEOLOGICAL SOCIETY, at 8.—Another Possible Cause of the Glacial Epoch: Prof. Edward Hull, F.R.S.—On the Affinities of the Echinothuridæ, and on Pedinothuria and Elikodiadema, Two New Genera of Echinoidea; On Echinocystis and Palæodiscus, Two Silurian Genera of Echinoidea: Dr. J. W. Gregory.

ENTOMOLOGICAL SOCIETY, at 8.

SOCIETY OF PUBLIC ANALYSTS, at 8.—Some Analyses of Water from an Oyster Fishery; Note on Weighing out Fats; Remarks on Formaldehyde: Chas. E. Cassal.—Note on Formalin: Dr. Samuel Rideal and Ronald Orchard.—Notes on Prussian Blue: Frank H. Leeds.—The Estimation of Borax and Boracic Acid in Milk: Frank P. Perkins.—Note on Copper in Oysters: W. F. Lowe.—The Statement of Analytical Results: J. F. Liverseege.

THURSDAY, DECEMBER 3.

LINNEAN SOCIETY, at 8.—Does Natural Selection play any part in the Origin of Species among Plants: Rev. Geo. Henslow.

CHEMICAL SOCIETY, at 8.—Election of Fellows.—Constitution and Colour: Arthur G. Green.—Some Experiments on Sea-water: E. Sonstadt.—Derivatives of α-Hydrindone: C. Revis and Dr. F. S. Kipping.—Notes on Nitration: Dr. H. E. Armstrong.—2:3′ Bromobetanaphthol: Dr. H. E. Armstrong and W. A. Davis.—Derivatives of Nitrobetanaphthols: W. A. Davis.—Morphotropic Relations of Betanaphthol Derivatives: W. A. Davis.—Researches on Tertiary Benzenoid Amines: Miss C. Evans.

FRIDAY, DECEMBER 4.

GEOLOGISTS' ASSOCIATION, at 8.—The Foraminifera of the Thanet Beds of Pegwell Bay: H. W. Burrows and Richard Holland.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Address by J. Wolfe Barry, C.B., F.R.S. (President).—Railway Signalling: David W. Kinmont.

SUNDAY, DECEMBER 6.

SUNDAY LECTURE SOCIETY (St. George's Hall), at 4.—New Zealand—the World's Wonderland: W. Herbert-Jones.

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

BOOKS.—Habit and Instinct: C. Lloyd Morgan (Arnold).—Gleanings from the Natural History of the Ancients; Rev. M. G. Watkins (Stock).—The Metric System of Weights and Measures: Prof. W. H. Wagstaff (Whittaker).—The Dynamo: C. C. Hawkins and F. Wallis, 2nd edition (Whittaker).—Auto-Cars: D. Farman (Whittaker).—"Carriages without Horses shall go": A. R. Sennett (Whittaker).—Transformers for Single and Multiphase Currents: G. Kapp (Whittaker).—A-birding on a Bronco: F. A. Merriam (Boston, Mass., Houghton).—Prehistoric Man and Beast: Rev. H. N. Hutchinson (Smith, Elder).—Cambridge Natural History. Vol. 2. Worms, Rotifers, and Polyzoa: Gamble, Sheldon Shipley, Hartog, Benham, Beddard, and Harmer (Macmillan).—Hindu Astronomy: W. Brennand (Straker).—The Earth and its Story: Prof. A. Heilprin (Gay and Bird).—British Patent Laws and Patentees' Wrongs and Rights: H. Haes (Whittingham).—Elements of Differential Calculus: Prof. E. W. Bass Chapman).—Locomotive Mechanism and Engineering: H. C. Reagan, jun., 2nd edition (Chapman).—Notes for Chemical Students: Prof. R. T. Austen, 2nd edition (Chapman).—Experiments upon the Contraction of the Liquid Vein issuing from an Orifice: H. Bazin, translated by J. C. Trautwine, jun. (Chapman).—A Text-Book on Shades and Shadows and Perspective: J. E. Hill, 2nd edition (Chapman).—Tables for Iron Analysis: J. A. Allen (Chapman).—Handbook of Courses open to Women in British, Continental, and Canadian Universities: J. Maddison (Macmillan).—Journal and Proceedings from the Royal Society of New South Wales for 1895, Vol. xxix. (Sydney).—Report of the Commissioner of Education for the Year 1893–4, Vol. 2 (Washington).—Botanical Microtechnique: Dr. A. Zimmermann, translated by J. E. Humphrey (Constable).—The True Grasses: E. Hackel, translated by F. Lamson-Scribner and E. A. Southworth (Constable).—Charles Pritchard, D.D., F.R.S., &c.: A. Pritchard, and others (Seeley).—Chemistry for Engineers and Manufacturers. Vol. 2. Chemistry of Manufacturing Processes: B. Blount and A. G. Bloxam (Griffin).—Select Methods in Inorganic Quantitative Analysis: Prof. F. C. Smith (Edinburgh, Clay).—Among British Birds in their Nesting Haunts, illustrated by the Camera: O. A. J. Lee, Part 1 (Edinburgh, Douglas).

PAMPHLETS.—Sulla Propagazione dell' Electtricita nei Gas Attravusati dai Raggi di Röntgen: Prof. A. Righi (Bologna).—The Principal Household Insects of the United States (Washington).—Revue Météorologique. Travaux du Réseau Météorologique du Sud-Ouest de la Russie dix ans d'Existence: A. Klossovsky (Odessa).

SERIALS.—Encyklopædie der Naturwissenschaften, Erste Abthg., 69 to 70 Liefg., Dritte Abthg. 34 to 37 Liefg. (Breslau, Trewendt).—The Bachelor of Arts, November (New York).—Physical Review, Vol. iv. No. 2 (Macmillan).—Publications of the Leander McCormick Observatory of the University of Virginia, Vol. 1, Part 7 (Charlottesville).—Proceedings of the American Academy of Arts and Sciences, new series, Vol. xxiii. (Boston, Mass., Wilson).—Morphologisches Jahrbuch, 24 Band, 3 Heft (Leipzig, Engelmann).—Centralblatt für Anthropologie, &c., 1896, Heft 4 (Breslau, Kern).—Astrophysical Journal, November (Wesley).

CONTENTS.