THURSDAY, JUNE 10, 1897.

PLANT PATHOLOGY.

Diseases of Plants induced by Cryptogamic Parasites. By Dr. Karl Freiherr von Tubeuf. English Edition, by William G. Smith, B.Sc., Ph.D. Pp. xv + 598. (London: Longmans, 1897.)

WHEN the German edition of this work appeared, early in 1894, it at once took rank as one of the most comprehensive and accurate treatises on the subject that had as yet appeared, and the English edition we now have to welcome still deserves this tribute to its merits, for the author has taken the opportunity of adding considerably to the already bulky volume.

The fungus-diseases of plants now number so many forms, that no apology is necessary for treating them separately from the very numerous other diseases of plants; but it should be clearly borne in mind that only part of the very wide subject of the pathology of plants comes under this head, as may be readily seen on comparing the new edition of Frank's "Krankheiten der Pflanzen," which has appeared in the interval, and of which the first volume is devoted to the diseases due to non-living agents, the second to those caused by parasitic plants (not fungi only), and the third to pathological states induced by animals.

Thus comprehensive works on the whole range of this vast subject are not wanting, and the student should observe that the standpoint from which a treatise like this is written differs considerably from those assumed by writers on the general subject of pathology, or those who deal with the morphology and physiology of the fungi.

Berkeley, Frank, Sorauer, and Hartig have shown that the diseases of plants constitute a theme by itself which may be treated with reference either to the symptoms and progress of the pathological conditions, where the victim of disease furnishes the principal phenomena discussed, or to the causes or agents which induce these pathological conditions. These agents may be internal or external, and the latter comprise factors of the non-living environment, or living organisms—animals or plants in anti-biotic relations to the host, or victim.

The present large volume, of more than 600 pages with 330 illustrations, is devoted, as said, to the narrower theme, and bears witness to the astonishing progress made in the study of the parasitic fungi during the last quarter of a century.

Its subject-matter is principally the fungi themselves, and in character it partakes of the nature of a flora or diagnostic list, and a treatise on symptoms and therapeutics, with bibliographical references for those who wish to launch further into this particular arm of the sea of knowledge. It is thus neither a complete treatise on the biology of fungi, nor a detailed work on pathology, but—and in this reside its peculiar characteristics—a volume compiled to meet the wants of an increasing class of students who wish to know something of the parasitic fungi themselves and what plants they attack; something of the mode of attack and the symptoms induced; and something of the suggestions for combating the diseases which have been supplied by experiments in the field. It is thus a typical example of a class of book evolved under the stimulus of the practical spirit of the age, and, in fairness to all be it said, of a high standard of excellence as scientific literature; further, it will be of no use to the crammer, to the examinee, or the dilettante, but must take its place on the shelf of the serious worker, the true naturalist, and the educated cultivator of plants as an indispensable work of reference.

The book consists of two parts, of which the first contains chapters on the nature of parasites and parasitism, the reactions between host and parasite, infection, predisposition, preventive measures, and the economic importance of the diseases of plants, together with a short summary of the facts of symbiosis.

The second, and far larger part, is devoted to a systematic account of cryptogamic parasites—the fungi proper, slime-fungi, bacteria and pathogenic algæ being included. The system followed is that of Brefeld, the saprophytic forms being omitted.

Objection may be made to the inclusion of the algæ and symbiotic forms, such as mycorhiza, the organisms of the leguminous nodules, lichens, &c.; but Tubeuf has something of his own to say about these matters, and although I do not agree with his strained attempts to classify the phenomena of saprophytism, parasitism, and symbiosis, and regard his selection and definition of the terms *nutricism* and *individualism* as particularly unfortunate and misleading, I think that he was quite right in discussing these matters here, if only to help in emphasising the real nature of parasitism by contrast.

The author has avoided several pitfalls. It would have been easy to give way to temptations to discuss in detail several disputed points, especially as Tubeuf is himself an investigator with strong views of his own; but it is noticeable throughout that he attempts a fair summary of the published accounts. The fault of over-description has also been wisely and ably avoided, and this, on the whole, without sacrifice of usefulness; though it must be borne in mind that a good deal of preliminary acquaintance with the subject is necessarily demanded from the reader. Again, there is sufficient treatment of theoretical matters to make the book attractive to botanists not specially concerned with pathology in detail, and, further, the hints on practical therapeutics, though necessarily short, appeal to the cultivator himself, and show that the book is designed to help him.

One fault of omission must be mentioned, if only in justice to those who have done good work in this country: the English literature is almost wholly ignored. We hesitate whether to blame the author—who only follows the too common practice of continental writers—or the editor for this. In any case the latter might have included references to Massee's and Somerville's experiments with *Plasmodiophora*, in his notes, to say nothing of other work by English botanists.

A feature in the work, which adds immensely to its value, is the selection of photographic illustrations of the diseased plants themselves, showing how the victims of fungus attacks look. This is as near an approach to taking the student into the field and showing him the disease at work, as can possibly be made in a book; and when we reflect that this—so to term it—clinical study is as important for plant diseases as it is in the case of human diseases, its importance is obvious. Few people are aware how

much there is to be seen and learnt in the natural history of the diseases of forest and field and garden plants, and Tubeuf's examples should stimulate botanists to pay more attention to the subject. It is true the reproductions of the photographs are by means of the detestible "process blocks," which disfigure most of the books of the present age; but I suppose we must agree that the choice lies between these or none, as prices and means go.

It will be evident that the book is too large for even a brief review of more than the principal headings, but there are one or two features of importance which stand forth in salient contrast to anything met with in similar works.

These are signs of the times. One of the most striking is the far too meagre note on "selection of hardy varieties"—the word "hardy" does not accurately translate the original. From all sides we are now hearing that different varieties of vines, potatoes, wheat, &c., show different disease-resisting powers, and Tubeuf says, "An important method for the protection of plants from disease . . . consists in the selection and cultivation of varieties and species of plants able to resist the attacks of parasitic fungi."

The very brief account of what has been done with the vine, and the reference to what has been discovered about wheat, will only leave the reader hungry for more information.

In Eriksson and Henning's exhaustive volume on wheat-rust—to which I can discover no reference here, the author confining his remarks to a note they published last year in the *Zeitschrift f. Pflanzenkrankheiten*—the student will find that as matter of fact some varieties of wheat suffer little, and others much from *Puccinia;* and their extended investigations show that no mechanical theory as yet proposed explains this, but that a complex physiological phenomenon is here before us. They also show that the *Puccinia* of wheat-rust also varies, both morphologically and in its physiological relations to the disease. We have, in short, to face the fact that the culture of wheat-rust (for we do cultivate it), as well as the culture of cereals, result in the variation of both fungus and cereal, and it appears that selected varieties of both arise and are propagated.

Such varieties of parasitic fungi are also known in other groups—*e.g. Peridermium*, *Gymnosporangium*, *Ustilago*, &c.—and Tubeuf gives a short note under the respective heads; and we have several indications that physiological races are as common among parasitic fungi as they are among bacteria.

Clearly it is matter for experimental inquiry how far these variations are independent or concomitant, and it may be considered that one of the strongest reasons for encouraging the carrying out of agricultural experiments on a large scale, and the gathering of statistical results, that scientific men can urge, is the hope that more light will be thrown on the relations of these variations, and that we may succeed in utilising the knowledge in the practical evasion of disease. I remember being strongly impressed, in 1880–81, by the varietal differences between the *Hemileia* on coffee and that on *Canthium* in Ceylon, and even then threw out the hint that the former had been derived from the latter; but the comparative immunity of *Coffea Liberica* as contrasted with *C. Arabica*, suggested that it was not impossible that a disease-resisting coffee should be found.

The subject is complex, and bristles with difficulties; but that is no reason for hesitating as to the experimental inquiry; and indeed it has already been commenced in several countries, as the reports from Australia, America and elsewhere show.

Another feature of interest and importance in Von Tubeuf's book, is the chapter on "preventive and combative measures," involving the treatment of diseased plants by means of chemicals. Here, again, I notice a lack of attention to the English literature: Berkeley, and others of our countrymen, had experimented with sulphur in various forms, long before most of the authorities mentioned had taken the matter up. Still, it is quite true, the introduction of Bordeaux-mixture, and its employment on the enormous scales adopted in France, Australia, America and elsewhere, have taught us much, and suggested more. It is a common mistake to suppose that the intelligent application of remedial measures to plant-diseases does not pay—there are plenty of witnesses to the contrary; but, unfortunately, school and university courses generally have allowed of so little attention to the knowledge that must be utilised in carrying out such measures, that even skilled farmers, foresters, and other cultivators of plants, have to enter upon these experiments quite unequipped for carrying them out properly.

Tubeuf's chapter on the "economic importance of diseases of plants" may be cordially—if sadly—recommended to all who are interested in the very necessary extension of technical education by the institution of agricultural schools and colleges. He quotes the losses due to the Californian vine-disease (1892) at 10,000,000 dollars; in 1891 the wheat-rust cost Prussia over 20,000,000*l.*, and Australia something like 2,500,000*l.* Even allowing for large exaggerations—though reports from Sweden, India, Ceylon, the West Indies, and elsewhere suggest similarly large losses from fungus epidemics—in these estimates, it is evident that we have here to deal with annual losses of which even a saving of a very few pounds *per cent.* would be worth consideration; and the comparatively meagre experiments to hand hold out hopes of much more considerable saving, if steps are taken in time, with a due and intelligent knowledge of the problems to be faced, and the methods of facing them.

This must suffice for our review of this excellent book, the technical details of which are well treated, of the highest importance, and abounding with interest to the naturalist and botanist, as well as to the technologist and practical cultivator. H. MARSHALL WARD.

CAPTAIN LYONS' REPORT ON THE ISLAND OF PHILÆ.

A Report on the Island and Temples of Philæ. By Captain H. G. Lyons, R.E.; with an Introductory Note by W. E. Garstin, C.M.G. (Printed by order of H.E. Hussein Fakhri Pasha, Minister of Public Works in Egypt, 1897.)

THE proposal to build a dam at Philæ, which was brought before the Egyptian Government a few years ago, at the instance of Mr. Willcocks, of the Irrigation Department of Egypt, will be fresh in the memory of many of our readers, even though the details of the

somewhat acrimonious discussion upon it which followed in the papers have been forgotten. Briefly, the Egyptian Government had been informed by its English advisers that a better regulated and larger supply of water was needed for agricultural purposes in that part of the valley of the Nile which lies between Aswân and the Mediterranean Sea, and steps were at once taken to find out how that supply could be secured. Mr. Willcocks was ordered to seek out a site where a huge dam could be built for the purpose of holding back the water behind it; and after much thought and careful examination of the various possible sites, he decided that the best place was at Aswân, a few miles to the north of the beautiful little island of Philæ. The announcement of this decision was received with astonishment and outcries, for it needed no expert knowledge to see that the carrying out of the scheme meant, practically, the destruction of the monuments upon the island, and the submerging of both it and the greater part of the buildings upon it for a considerable number of weeks each year. When Mr. Willcocks' scheme was put before the public in its entirety, it was seen that he had indeed contemplated this disastrous result with calmness, and that if his superior officers accepted his report, one of the most picturesque spots in Egypt would be turned into a huge reservoir. Thereupon followed vigorous protests in England and other civilised countries, and at length the characteristic English compromise was proposed. As was to be expected, the usual nonsense was talked and written by the irresponsible person and faddist, and even archæologists signed their names cheerfully at the foot of columns of vehement protests filled with loose statements and inaccuracies. There is no blinking the fact that an attempt was being made to destroy a unique and very lovely bit of scenery, but it must at the same time be remembered that the actual needs of an agricultural population of a country have to be considered, even at the expense of the gratification of the æsthetic sentiments of visitors from other countries. Fortunately, when the dispute was hottest, certain irrigation experts discovered that all practical advantages necessary would be secured to the Egyptian farmer if the height of the water in the proposed reservoir was less than that suggested by Mr. Willcocks, and Mr. Garstin was able to modify the scheme in such a way as to reduce it by about twenty-seven feet. So that if the reservoir is ever built, Mr. Garstin promises us that "the greater portion of the ruins on the island will remain permanently above the submerged level."

Having agreed to adopt a modified scheme for the building of the dam and for the formation of the reservoir, it next became the duty of the Egyptian Government to take steps to see that the monuments *in situ* were not destroyed by the water in which their lower courses must stand, and, as a result, it ordered that the foundations of these structures should be examined and reported upon. To carry out this important work Captain H. G. Lyons was appointed, and the handsome volume before us contains the results of his labours at Philæ during the last two or three years. Without going into details, it must suffice here to say that he has carried out his work conscientiously, and that every person who has ever seen Philæ will accord him his heartiest thanks for the splendid series of photographs and plans of the island which accompany his report. But however interesting these may be, they are relatively of small importance beside the facts concerning the foundations of the buildings on the island which he now makes known to the world, and we feel sure that the minds of many will be much relieved thereby. It has long been known that the architects of ancient Egypt gave their finest buildings but shallow foundations; but that this was not universally the case is proved by the Temple of Isis at Philæ, in which the foundations of the main buildings descend to the bed rock, and many will be surprised to learn that there is as great a depth of masonry below the ground surface as there is height above it.

"Even in the case of the great pylon," Mr. Garstin says, "the depth of the foundation is some five metres; so that the masonry already descends below the level permanently saturated by infiltration, and consequently the conditions of equilibrium of the structure will be unchanged, even should the water-level be very considerably raised."

Along with the examination of foundations, Captain Lyons has effected a considerable number of important repairs, which have been unostentatiously carried out; and if the other measures which he recommends be adopted, it seems probable that little or no danger to the temples will exist, even should the water yearly rise and fall around their bases. This is Mr. Garstin's view of the matter, and, after all, he is the responsible person ultimately. Briefly, if the reservoir be made, much of the quay wall will have to be rebuilt, and the underground spaces between the cross-walls, which support the pavement of the west colonnade, and the crypts of the great Temple of Isis will have to be filled up with rough masonry. The picturesque remains of the Coptic village, at Philæ, must, of course, disappear, because the mud-brick walls will not withstand the action of the water; but archæologists have long ceased to expect to find there any Coptic antiquities of importance, and consequently will not grieve overmuch. Satisfactory as Captain Lyons' report is in all respects, we cannot help feeling that Egyptologists will be disappointed at one result—that is, his failure to find the remains of any building older than the time of Nectanebus, the last native king of Egypt, about B.C. 360. This is, of course, not his fault, but one of the early investigators of Egyptian antiquities, mentioned by Lepsius in his "Letters from Egypt" (London, 1853, p. 525), expressly states that the remains of much earlier buildings were found built into the structures of the Ptolemaïc period. That the Egyptians, before the time of Nectanebus, made no use of the island of Philæ, it is impossible to believe, especially as they built edifices upon the neighbouring island of Biggeh. So far back as B.C. 3500 we know that Egyptian officials passed that way on their road south to bring back pygmies for the royal court at Memphis, and all the gifts and tribute from the south must have been carried into Egypt by that way. In the time of the twelfth dynasty, about B.C. 2500, a body of lightly-armed "runners" was attached to the garrison at Aswân, whose duty it was to guard the cataract, and it is hard to think that Philæ did not form a base for operations at this period. About one thousand years

later a temple of Osiris seems to have stood on the island, for a governor of Nubia, called Merimes, cut his name, which is found, along with those of his predecessors and successors, in remembrance of a visit thereto, on rocks on the island of Biggeh (see Brugsch, "Egypt," i. p. 423). In the reign of Rameses II., the builder of the temples at Kalabsheh and Abû Simbel, no mention is made of Philæ, and, curiously enough, no remains inscribed with his prænomen and nomen have been found there. The probable explanation of the silence of the monuments about Philæ is that the island was usually reckoned as a part of Biggeh, and even the Greeks and Romans included both islands in the name of Philæ. Be this as it may, we believe that a temple, or temples, existed at Philæ from the earliest period, and that their remains were removed entirely by those who set up the buildings for Nectanebus and his successors; for, after Captain Lyons' exhaustive survey, it is impossible that any can be found there.

It is now our pleasant duty to call the reader's attention to the series of sixty-seven plates which illustrate Captain Lyons' report, and to fully endorse Mr. Garstin's statement that if the ruins of Philæ were to "disappear to-morrow, the scientific world would still possess a record of each detail of their outline and construction," and we rejoice to hear the promised survey of Nubia has been already begun. Though every intelligent person would view with indignation the slightest damage done unnecessarily to the temples at Philæ, still it must be admitted that antiquarian sentiment should not stand in the way of the prosperity of the country of Egypt. If the scheme of a reservoir at Aswân produces a complete survey of the country for two hundred miles south of it, we may hope that a scheme for a reservoir at Gebel Silsileh will be followed by a complete survey of the country to the north of it. Finally, we congratulate Mr. Garstin and Captain Lyons on the completion of a delicate piece of work, and thank H.E. Hussein Fakhri Pasha for sending forth to the world the results in such a sumptuous form.

ASSAYING IN WORKS LABORATORIES.

Notes on Assaying. By P. de P. Ricketts, E.M., Ph.D., Professor of Analytical Chemistry and Assaying, School of Mines, Columbia University; and E. H. Miller, A.M., Ph.D. of Columbia University. Pp. viii + 311. (New York: John Wiley and Sons. London: Chapman and Hall, Ltd., 1897.)

Recueil de Procédés de dosage pour l'analyse des combustibles, des minerais de fer, des fontes des aciers et des fers. Par G. Arth, Professeur de Chimie Industrielle à la faculté des Sciences de Nancy. Pp. iii + 313. (Paris: G. Carré et C. Naud, 1897.)

THE reissue in a new and enlarged form of Prof. Ricketts' well-known book will be welcomed by all who have used the former editions. As Dr. Miller now assists his chief, the book appears as a new one. It is intended to be used in the laboratories of works where only notes for reference are required, and long and detailed descriptions of well-known operations are unnecessary. The result is that it is written in a crisp and telegraphic style, which should commend itself not only to Americans, but to all busy assayers. On the other hand, students would often require a little supplementary oral teaching to enable them to perform the operations efficiently.

The first part, comprising an account of apparatus, reagents and methods, is good of its kind, although there is little that is new. Regarding litharge, there is a noticeable statement that "it should be free from red oxide of lead, as the latter has the power of oxidising silver and thus causing loss of that metal during the assay." This property, however, is shared by litharge; and it would be interesting if experiments were made showing the relative losses due to the action of the two reagents.

In the part dealing with the fire assays of ores and of bullion, the most interesting sections are those on the assay of gold and silver. The method given of parting the beads from gold ores, by heating them with acid in porcelain crucibles, is seldom used in this country, though it is in general use in America and Australia Its merits are little understood in Great Britain, where it is often adversely criticised. It would appear that no adequate defence of it has yet appeared in print, though it would not be difficult to furnish one. Space forbids any attempt of the kind here. It is sufficient to observe that objections to it have been raised mainly by those who have never tried it, and who do not know how easy it is to obtain exact results by its aid.

The method of assay of gold bullion is described as being that used at the Royal Mint, London, where, the authors imply, the greatest accuracy is obtained. Besides the assay of all metals usually found in ores, an account of qualitative blow-pipe analysis is given, and the whole book is far more complete in its present form than was the case with the previous issues.

M. Arth's book is also one of considerable merit. It is an account of the exact methods of analysis used in iron and steel works in France, and will be useful to the works analyst in all countries. It distinguishes between two kinds of analyses: the one required as a daily control of the works, the other to serve as a basis for experiments or in delicate researches. The rough and ready methods employed for the former purpose are, of course, unsuitable for the latter, and *vice versâ*. Both kinds are described, but the first-named class is undoubtedly the more efficiently treated, the Kjeldahl method for the estimation of nitrogen in fuel being, for example, fully described, and Dumas' method deliberately omitted except by name.

The methods of analysis used in steel works in France do not appear to differ materially from those used in this country, and some which are described were even devised on this side of the Channel. It is evident, therefore, that this book will prove as useful to our analysts as to their colleagues in France.

OUR BOOK SHELF.

Life and Letters of William Barton Rogers. Edited by his Wife, with the assistance of William T. Sedgwick. Vol. i. pp. viii + 427. Vol. ii. pp. vi + 451. (Boston and New York: Houghton, Mifflin, and Co., 1896.)

A TRULY great achievement of the life of William Barton Rogers was the foundation and establishment of the Massachusetts Institute of Technology, which ranks among the best technological schools in the world. His scheme was adopted by a general committee in October 1860, and

it became the basis of the present Institute. If Mr. Rogers had accomplished no more than this, he would yet have done a great service to the cause of science and education. He was, however, an active investigator, and the two volumes before us testify to the keenness of his interest in all scientific subjects.

William Rogers was born in 1804. He became professor of natural philosophy and chemistry at William and Mary College, Williamsburg, Virginia, in 1828, and professor of natural philosophy in the University of Virginia, and director of the geological survey of Virginia, in 1835. He resigned his professorship in 1853, and removed to Boston, where, a few years later, he took the chief part in founding and organising the Massachusetts Institute of Technology. The physical laboratory of the Institute was afterwards given the designation of "The Rogers Laboratory of Physics," in recognition of his services to physical science and devotion to the interests of the Institute. Mr. Rogers was president of the American Association for the Advancement of Science in 1876, and succeeded Prof. Henry as president of the National Academy of Sciences in 1879. He died suddenly in May 1882, while delivering a short address to the students of the Institute of which he was the father.

Prof. Rogers was one of a gifted quartet. His brother Henry became Regius Professor of Natural History and Geology in the University of Glasgow in 1857, and was elected a Fellow of the Royal Society in the following year. To the two brothers William and Henry, geology owes the wave theory of mountain chains—a theory deduced from an extended study of the great Appalachian chain. The eldest of the four brothers, James Rogers, served as professor of chemistry, successively, in the Philadelphia Medical Institute, the Franklin Institute, and the University of Pennsylvania. Upon his death in 1852, the youngest of the brothers, Robert, then professor of chemistry in the University of Virginia, succeeded him in the chair of chemistry at Philadelphia. It was in connection with Robert Rogers that William investigated the solvent action of water—especially when charged with carbon dioxide—on various minerals and rocks.

The wide range of William Rogers' studies and researches, his eminence among men of science in America, his enthusiasm for the advancement of knowledge, and his fraternal affinities, have all assisted in providing material for the two volumes under notice. The memoir is practically filled with letters, only sufficient editorial comment being added to make it a connected history. It would be easy to fill many pages of NATURE with interesting extracts from these letters, but the limitations of space forbid. Naturally the volumes will appeal most to Prof. Rogers' American contemporaries, and to the officers, graduates, and students of the Institute to which they are dedicated. There are, however, many British men of science who will be interested and inspired by this record of his life and work.

L'Ottica delle Oscillazioni Elettriche. By Prof. A. Righi. Pp. vii + 254. (Bologna : Zanichelli, 1897.)

TWO years ago (May 9, 1895) we drew attention to two memoirs by Prof. Righi, who in 1893 succeeded in producing and investigating the behaviour of Hertzian waves only a few centimetres in length. He has now collected the results of these and other researches, which he has made, in the form of a convenient volume, arranged in two parts. The first contains a detailed description of his apparatus, its mode of construction and use, together with the effects which can be produced by it, especially such effects as are easily exhibited by electro-magnetic waves, but only with difficulty by light-waves, on account of the extremely short wave-length of the latter. The second and longer part corresponds more closely to the title of the book, and gives an account of the following phenomena : interference-phenomena with electro-magnetic waves carried out with experimental arrangements which in the main correspond exactly to the well-known optical ones (*e.g.* Fresnel's mirror and the bi-prism); experiments analogous to the interference of light in thin plates ; diffraction-experiments ; absorption, transparence and opacity ; reflection from the surfaces of conductors and dielectrics ; experiments in reflection and total reflection which are exact analogues of optical experiments with prisms, lenses and totally reflecting prisms ; elliptic and circular polarisation, and double refraction. An appendix contains a series of notes on the theory of electro-optics. The book is well printed and illustrated, and will be welcomed by all who are interested in the development of the work of Maxwell and Hertz. *pv.*

The Concise Knowledge Natural History. Edited by Alfred H. Miles. Illustrated. Pp. xvi+771. (London : Hutchinson and Co., 1897.)

THIS book of less than 800 octavo pages deals with the animal life of the world. The arrangement is systematic ; the space allowed to each group is proportioned to its popular interest, and the authors have done what they could under the prescribed conditions to make their contributions readable. Since the Vertebrates occupy more than five-sevenths of the volume, the Invertebrates come off poorly. Mammals, by Mr. Lydekker, and Birds, by Dr. Bowdler Sharp, are more liberally treated, and these sections are far more interesting than the rest. It will be seen that though the book has its merits, its use is limited. We can hardly recommend it to students or to field-naturalists, or to collectors, but it will suit those who desire information about the animals which they meet, not in the flesh, but in the newspaper or book of travel. The quantity and quality of the information are equal to what would be found in any encyclopædia except the Britannica. The cuts, which are numerous, are not good ; some of the frogs and salamanders, for instance, are almost unintelligible. There is a full index, which will prove a useful feature. Is it worth while to point out that there is no such plural as *Animalculæ?*

L. C. M.

Through a Pocket Lens. By Henry Scherren, F.Z.S. Pp. 192. (London : The Religious Tract Society, 1897).

GIVE this book to an intelligent boy or girl with a taste for natural history, and let it be used not merely as a reading-book, but as a guide-book to nature study, and you will do more towards cultivating the spirit of investigation than by dozens of lectures. The common idea that very little real work can be done without a compound microscope and numerous accessories has tended to discourage young naturalists, but Mr. Scherren describes so many interesting objects, all of which have been seen by him with a pocket lens, that his book will induce many to study nature who would otherwise acquire knowledge second-hand. All the examples described are taken from the Arthropoda. The group is interesting, and specimens belonging to it are so common that they can easily be procured. We have no doubt that many young students will profit by this instructive introduction to one of the main divisions of the animal kingdom.

The Young Beetle Collector's Handbook. By Dr. E. Hoffman, Curator of the Royal Natural History Museum at Stuttgart ; with an Introduction by W. Egmont Kirkby, M.D. Pp. viii + 178. (London : Swan Sonnenschein and Co., Ltd., 1897.)

THIS work contains twenty coloured plates, comprising about 500 figures of Coleoptera, which may certainly, in many cases, prove of considerable service to the young beetle collector ; but the letterpress is of comparatively little value, consisting, as it does, mainly of very short and more or less disjointed descriptions of selected

genera and species. In a work with such a title one expects rather to find a detailed description of the methods of procedure as regards capture, habits, habitats, &c., and not to require the young collector to plunge *in medias res* without such knowledge. The introduction certainly attempts to deal with these points, but it only consists of eleven pages of large print; and the all-important subject, in such a work, of "the habits of beetles and how to catch them" is dismissed in about thirty lines.

The plates are worth the cost of the work, which may be found useful for a somewhat more advanced student, but which hardly appears to realise our idea of a "Young Collector's Handbook."

Exercises in Practical Physiology. By Augustus D. Waller, M.D., F.R.S. Part iii. Pp. 91. (London: Longmans, Green, and Co., 1897.)

THE exercises and demonstrations contained in this and the two preceding parts are primarily intended to facilitate class work in physiology, and for use in conjunction with such a text-book as the author's "Introduction to Human Physiology." The present part contains sixty-eight instructive experiments on the physiology of the nervous system, and descriptions of the instruments used in investigations in electro-physiology generally. The subject is one which the author has made peculiarly his own; so that the experimental details will be found sufficient to enable students and demonstrators to set up the required apparatus satisfactorily and obtain good results. The book affords a strong argument for the teaching of the principles of physics to students of physiology; for without this fundamental knowledge it would be impossible to perform the experiments intelligently.

Year-Book of the Scientific and Learned Societies of Great Britain and Ireland. Fourteenth annual issue. Pp. 270. (London: Charles Griffin and Co., Ltd., 1897.)

THIS work, in addition to being a convenient handbook of our scientific societies, contains lists of the papers read during 1896 before societies engaged in fourteen departments of research. It is thus a very useful index to scientific progress, as well as an indispensable book of reference to the officers, places and times of meetings, publications, and membership fees, of British Societies for the advancement of knowledge of every kind.

LETTERS TO THE EDITOR.

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

The Trotting Horse.

IN "The Primary Factors of Organic Evolution," Prof. Cope, whose recent death has taken from us an untiring worker and suggestive writer, adduces the evolution of the trotting horse as an illustrative case of the inheritance of characters due to the exercise of function (p. 426). Prof. Brewer, of Yale, is quoted at some length. He says: "There is every appearance and indication that the changes acquired by individuals through the exercise of function have been to some degree transmitted, and have been cumulative, and that this has been one factor in the evolution of speed. . . . There is nothing whatever in the actual phenomena observed anywhere along the line of this development of speed that would lead us to even suspect that the changes due to exercise of function had *not* been a factor in the evolution, and there is not a particle of evidence, other than metaphysical deductions, much less proof, that it would or could have gone on just the same by mere selection and adventitious variation" (pp. 429-430).

Mr. A. J. Meston, of Pittsfield, Mass., has recently discussed this question statistically in a pamphlet entitled "The Common Sources of 2·10 trotting and pacing speed." The results of this seemingly very careful investigation are of such general biological interest, that I have no hesitation in requesting space to draw attention to Mr. Meston's conclusions.

The first point that is especially noteworthy is the predominant influence of one horse, Hambletonian 10 (1849-1876). "While we have extreme speed without the aid of Hambletonian, it is, nevertheless, a fact that the influence of Hambletonian has been exerted amongst 92 per cent. of the 2·10 trotters, and 84 per cent of the 2·10 pacers [that is to say, trotters or pacers who can cover a mile in two minutes and ten seconds or under] We have pacing speed, apart from Hambletonian, within two seconds of the best record; but trotting speed without Hambletonian is four seconds behind the fastest mile. No mile has yet been trotted faster than 2·07¾ without the aid of Hambletonian. . . . Furthermore, the majority of both the trotters and pacers that descend from Hambletonian have more than one cross of his blood. . . . A very superficial examination of the blood of the 2·10 list shows that Hambletonian has exerted a predominant influence in its formation" (pp. 6-7).

The second point is the conclusion to which Mr. Meston is led with regard to the transmission of acquired speed. "It appears from the table," he says, "that some stallions and mares, after having been trained to fast records, have got foals that made fast records. It also appears that demonstrated capacity for speed and the ability to beget speed are qualities possessed in common by many stallions and mares, but the relative dates of 'making the record' and 'getting the foal' exclude the affirmation, if not the probability, of cause and effect between the two occurrences. It does not appear that a line of trained ancestors is more successful in producing speed than a line of untrained ancestors, or a mixed line of trained and untrained ancestry. Therefore, the evidence is negative upon the question whether increase of speed acquired by the individual through training, habit, or experience, is passed on to the foal, in any degree, by the force of heredity. On the other hand, the evidence is positive and convincing that congenital capacity for speed and innate plasticity for the development of speed are transmitted hereditarily to progeny, and that, by judicious or fortunate crossing, the capacity and plasticity have been vastly increased" (p. 23).

As this is the most careful statistical investigation of the kind with which I am acquainted, it appears to me that Mr. Meston's conclusions (which, he informs me, were not those that he anticipated at the outset of his inquiry) are worthy of careful consideration.

C. LLOYD MORGAN.

Bristol.

Fire-fly Light.

IN *Wiedemann's Annalen* for December last, Prof. H. Muraoka published an account of the rays which he found to be emitted by a fire-fly (described by him as a "Johanniskäfer"), and which resemble the rays which Dr. Dawson Turner has found to be emitted by glow-worms, in that they can pass (like Röntgen's rays and uranium rays) through aluminium. Can any reader of NATURE state what species of insect is known by this name? Muraoka describes them as on the average 13-15 mm. long; the largest being 20 mm. long. He says they have two (or in smaller insects three) rows of luminous spherules on the under side of its body, but that the whole body is photographically active. He used about 1000 insects at a time, with exposures of two to three days.

June 6. SILVANUS P. THOMPSON.

THE LIQUEFACTION OF FLUORINE.[1]

THE physical properties of a large number of mineral and organic fluorine compounds led to the theoretical prediction that the liquefaction of fluorine could only be accomplished at a very low temperature.

Whilst the chlorides of boron and silicon are liquids at the ordinary temperature, the fluorides are gaseous, and well removed from their boiling points. The same difference is noticeable in their organic compounds,

[1] "On the Liquefaction of Fluorine," by H. Moissan and J. Dewar. (Translated from *Comptes rendus* of the Paris Academy of Sciences, May 31, p. 1202).

ethyl chloride boiling at 12°, ethyl fluoride at −32°, propyl chloride boiling at +45°, ethyl fluoride at −2°.

Similar observations have been previously made by Paterno and Oliveri, and by Vallach and Heusler. These facts can also be connected with the experiments of Gladstone on atomic refraction. Finally, although clearly a member of the chlorine group, fluorine in some of its properties also presents some analogies to oxygen. The whole of these observations appear to clearly establish that fluorine would only with difficulty be reduced to a liquid, and it has already been shown by one of us that at −95°, under ordinary pressure, it does not change its state.

In the new experiments that we now publish, the fluorine was prepared by the electrolysis of potassium fluoride in solution in anhydrous hydrofluoric acid. The fluorine gas was freed from the vapours of hydrofluoric acid by passing it through a small platinum spiral cooled by a mixture of solid carbon dioxide and alcohol. Two platinum tubes filled with well-dried sodium fluoride completed this purification. The liquefaction apparatus consisted of a small cylinder of thin glass, to the upper part of which was joined a platinum tube. The latter contained another small tube of the same metal. The gas to be liquefied arrived by the annular space, passed into the glass bulb, and passed out again by the inside tube. This apparatus was united to the tube which led in the fluorine.

In these experiments we have used liquid oxygen as the refrigerating substance. This oxygen was prepared by the methods described by one of us, and these researches have necessitated the employment of several litres of this liquid. The apparatus being cooled to the temperature of quietly-boiling oxygen (−183°), the current of fluorine gas passed into the glass bulb without liquefying; but at this low temperature the fluorine had lost its chemical activity, and no longer attacked glass.

If now the pressure on the boiling oxygen be reduced, it is seen, as soon as rapid ebullition is produced, that a liquid trickles down the walls of the glass bulb, whilst no gas issues from the apparatus. At this moment, the exit tube is closed with the finger to prevent the entrance of any air. Before long the glass bulb becomes filled with clear yellow liquid possessing great mobility. The colour of this liquid recalls the tint of fluorine seen through a layer a metre thick. According to this experiment, fluorine becomes a liquid at about −185°. As soon as the little condensation apparatus is removed from the liquid oxygen, the temperature rises and the yellow liquid begins to boil, furnishing an abundant evolution of a gas which presents all the energetic reactions of fluorine.

We have taken advantage of these experiments to study some of the reactions of fluorine upon bodies maintained at very low temperatures. Silicon, boron, carbon, sulphur, phosphorus, and reduced iron, cooled in liquid oxygen, and then projected into an atmosphere of fluorine, do not become incandescent. At this low temperature, fluorine does not displace iodine from iodides. Its chemical energy, however, is still sufficiently great to decompose turpentine or benzene with production of flame even at −180°. It would seem that the powerful affinity of the fluorine for hydrogen is the last to disappear.

Finally, there is one other experiment that we ought to mention. When a current of fluorine gas is passed into liquid oxygen, there is rapidly produced a white flocculent deposit, which soon settles at the bottom of the vessel. If the mixture is shaken and poured on a filter, this precipitate is separated. It possesses the curious property of deflagrating violently as soon as the temperature rises. We are pursuing the study of this compound, as well as that of the liquefaction and solidification of fluorine, in which further experiments are required.

A NEW DETERMINATION OF THE GRAVITATION CONSTANT AND THE MEAN DENSITY OF THE EARTH.

AN account of a new determination of these quantities, carried out in a very careful manner by Dr. C. Braun, S.J., at Mariaschein in Bohemia, has just been published in the *Memoirs* of the Vienna Academy (Bd. lxiv., Math. Nat. Classe).

Dr. Braun has been engaged on the work since 1887. He used the torsion-rod method, and though his apparatus was considerably larger than that of Prof. Boys, it was still much smaller than the older apparatus of Cavendish, Reich, or Baily. The rod was about 24 cm. long, and was suspended from a tripod by a brass torsion wire, nearly 1 metre long and 0·055 mm. in diameter. The whole torsion arrangement was under a glass receiver, about a metre high and 30 cm. in diameter, resting on a flat glass plate. The receiver could be exhausted, and in the later experiments the pressure was about 4 mm. of mercury, and the disturbances due to air currents were very greatly reduced. The attracted masses at the end of the rod were gilded brass spheres, each weighing about 54 grammes. Round the upper part of the receiver, and outside it, was a graduated metal ring, which could be revolved about the axis of the torsion wire, and from this were suspended, about 42 cm. apart, the two attracting masses. Two pairs were used: one a pair of brass spheres about 5 kgms. each, the other, a pair of hollow iron spheres, filled with mercury, and weighing about 9 kgms. each.

To determine the position of the torsion-rod, a mirror was fixed on the centre of the rod, and immediately in front of it was a mirror at 45° to the horizontal, throwing the reflexion down through the base plate on to the horizontal objective of the observing telescope; another mirror, immediately under the lens, was inclined at 45°, and sent the beam horizontally on to a graduated glass scale in the focal plane of the eyepiece. The object of which the image was viewed was an index mark on a plate placed horizontally just below the scale, and the light from it was made to traverse the axis of the telescope outwards by reflexion at a parallel plate of glass at 45° to the horizontal. As the index mark was nearly at the same distance from the objective as the scale, the rays fell nearly parallel on to the torsion-rod mirror, and the angular value of the scale divisions was determined from their length and the distance of the scale from the objective. It was also determined by a theodolite, viewing the scale through the object glass, and found to be about 3½ min.

The instrument was fixed on a stone slab, in the corner of a room with very solid walls, and protected from temperature variations and electrical effects by a casing of cloth and tinplate.

As there was a continuous creep of the torsion-rod in one direction, amounting in the course of years to several lengths of the scale, it was necessary to have some method of moving the torsion-head. This was effected from outside the receiver in a very ingenious manner. A plate was fixed on a part of the torsion-head which did not revolve, and to this was attached a clock from which the escapement was removed, and on the axis of the escapement-wheel was fixed a small magnet. On the axis, where the driving spring had been, a pinion was fixed, gearing with a large wheel attached to the torsion-head. The magnet could be turned round by moving a magnet outside the receiver, and so the torsion-head could be slowly revolved. The gearing-down was such that, if the minute finger of the clock moved one minute, the image of the index in the telescope moved one scale division.

Vibrations of the torsion-rod were started by a light magnetised fork, which could be made to softly touch the rod on either side by the motion of a magnet outside the receiver.

The moment of inertia of the rod was determined, both by calculation and experiment, with very satisfactory agreement, and all the linear measurements of the apparatus, and of the distances, were made very carefully by horizontal and vertical cathetometers. Ingenious reflexion devices were used for measurements, which were made through the walls of the receiver.

Dr. Braun used both the deflexion method of Cavendish, and the oscillation method first used by Reich, to whom it was suggested by Forbes. In the deflexion method the attracting masses are placed outside the case, in such positions that their pulls on the attracted masses twist the rod round. The deflexion is observed, and the value of the corresponding torsion couple is determined by the time of vibration of the system. When the rod is deflected it does not, of course, take up its new position in a "dead beat" manner, but oscillates about it. The usual method of determining the centre of swing has been to observe successive elongations or turning-points, and by combining these in threes to eliminate the effect of decrement, and so to deduce the centre. But Dr. Braun found the centre more accurately by observing the times of transit of several scale divisions near the centre, in both directions. By interpolation he could determine the point about which the time of oscillation in either direction was the same, and this was taken as the centre of swing. The deflexion observed was about 13 divisions of the scale. The times of transit were registered on a chronograph.

The wire showed a certain amount of elastic after-action, and by subsidiary experiments on a similar wire this was as far as possible allowed for.

In the oscillation method the attracting masses are placed in a line with the torsion-rod, one at each end. Their attractions then act, not to deflect the rod, but to increase the restoring force, and so to lessen the time of vibration. The attraction is determined by comparing the times of vibration when the masses are in position, and when they are removed, or when they are placed so that the line joining their centres is at right angles to the rod.

The time of vibration observed by Dr. Braun was about 1275 seconds, and when the masses were put in position this was altered by about 46 seconds.

The results obtained in the years 1892 and 1894 were finally used, and these gave for the mean density of the earth—

	1892	1894
Deflexion method	5·529 ...	5·526
Oscillation ,, ...	5·520 ...	5·531

Giving due weight to the various observations, the final result is practically identical with that of Prof. Boys', viz.:

$$\text{Mean density} = 5{\cdot}52725 \pm {\cdot}0012$$
$$\text{Gravitation constant } G = 665{\cdot}786 \times 10^{-10}$$

J. H. P.

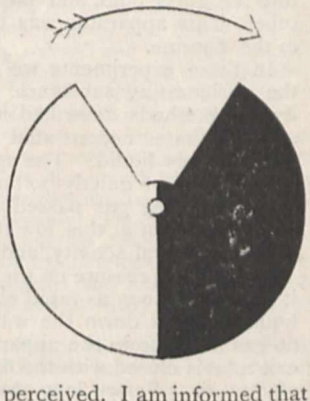
SUBJECTIVE TRANSFORMATIONS OF COLOUR.

IN a communication to the Royal Society on May 13, I described some curious experiments, showing how coloured objects might apparently be made to assume tints which were complementary to their actual hues—red, for example, appearing as green or greenish-blue, and green as pale red.

The phenomenon depends upon the rapid generation of negative after-images of the kind demonstrated by the familiar experiment with the red "wafer." If a red wafer lying upon a sheet of white paper is looked at steadily for about half a minute, and the gaze is then suddenly transferred to some other part of the paper, a greenish-blue ghost of the wafer will be seen. The portion of the retina upon which the red image at first falls becomes fatigued and partially insensible to red light; it is therefore unable to appreciate the red component of the white light afterwards reflected to it, and the sensation of the complementary colour consequently predominates.

The new experiments indicate that the preliminary stare may, under certain conditions, be an exceedingly brief one. In a paper published three years ago (*Proc. Roy. Soc.*, vol. lvi. p. 132) I called attention to an observation indicating that a short period of darkness imparts to the retinal nerves a degree of sensitiveness, which is far above the normal average in the light, and which quickly passes away again under the influence of illumination. This peculiar sensitiveness is in fact both acquired and lost in a small fraction of a second, and is therefore very favourable for the rapid production of negative after-images.

Let two small screens—one black and the other white—be held together in one hand, and arranged so that there may be a triangular gap between them. Let the black screen first cover the paper upon which the wafer is lying; this will darken a portion of the retina, and render it sensitive. Then let the screens be quickly moved sideways, so that the wafer may for a moment be exposed to view through the gap, the movement being stopped as soon as the paper is covered by the white screen. A bright but evanescent greenish-blue ghost will succeed the red impression. But the curious thing is that if the illumination is strong, and the screens are moved at the proper speed, no trace of red will be seen at all; it will appear exactly as if the actual colour of the wafer were greenish-blue. The action of light after a short period of darkness seems to have the power of appreciably diminishing the sensibility of the retinal nerve-fibres in a space of time so short, that if the light be coloured its colour is not consciously perceived. I am informed that analogous phenomena have been observed in other branches of physiology; a well-defined reaction sometimes occurs when no direct evidence can be detected of the existence of the excitation to which the reaction must have been due.



By the use of a rotating disc having a black and white[1] surface and an open sector, as in the annexed figure, the effect can be shown continuously. The disc is made to turn some six or eight times in a second, while its front surface is strongly illuminated either by bright diffused daylight or by a powerful lamp. An incandescent lamp of 32 candle-power at a distance of six inches gives excellent results; it should be placed opposite the disc, and should be provided with a small tin reflector to protect the eyes from the glare. A red card placed behind the disc is made to appear green, a green card pink, and a blue one yellow, while a black patch painted upon a white ground appears whiter than the ground itself. At the conversazione of the Royal Society on May 19, I exhibited some designs which had been prepared for the purpose of demonstrating the phenomenon in a striking manner. Among them was a picture of a lady with indigo-blue hair, an emerald-green face, and a scarlet gown, who was represented as admiring a violet sunflower with purple leaves. Seen through the disc the lady's tresses appeared flaxen, her complexion a delicate pink, and her dress a light peacock-blue, while the petals of the sunflower became yellow and its leaves green. Other designs showed equally remarkable transformations of colour.

SHELFORD BIDWELL.

[1] A pale brownish-grey tint is better than pure white.

INTERNATIONAL CONGRESS ON TECHNICAL EDUCATION.

THE fourth meeting of the Congrès Internationale de l'Enseignement Technique, to be held this year in London, on the invitation of the Society of Arts and the Worshipful Companies of Mercers, Fishmongers, Drapers, Goldsmiths, Merchant Taylors, Vintners, Clothworkers, Leathersellers and Carpenters, will be opened on June 15 by an address from the President, the Duke of Devonshire, and from the President of the last Congress, Mr. Léo Saignat.

This meeting of Congress, the previous meetings of which were—in 1886 (at Bordeaux), in 1889 (at Paris), and in 1895 (at Bordeaux), appears likely, if one may judge of the interest it is exciting, to be a success.

Invitations were sent through our Foreign Office to Foreign Governments to appoint delegates, and up to the present notice has been received of the appointment, by Belgium, of M. Eugène Rombaut, Inspector-General of Industries and Professional Education, M. Wanters, Assistant Inspector, and Dr. Pyffersen, of the University of Gand, and, by France, of M. Félix Martel, Inspector-General of Public Instruction. Invitations have also been sent to the Technical Instruction Committees of County Councils, and other bodies and institutions interested in the subject, to appoint representatives, and have met with a hearty response; also to bodies and institutions abroad of a like character, in which case an equally satisfactory result is expected.

There are also a large number of persons who, by the payment of the modest subscription of 5*s*., have become members of the Congress, and as such are entitled to all the privileges of the Congress.

After the opening addresses, the Congress will break up into two Sections—the subjects to be discussed, which have reference only to advanced and secondary instruction, falling under the heads of Industrial and Commercial Education—to meet simultaneously from 11 to 1 and 2.30 to 5 each day; one at the Society of Arts, the other at the London School of Economics, until Friday, at 2.30, when there will be the concluding meeting of the combined Sections. The list of those who have up to the present promised papers, so far as this country is concerned, is decidedly a strong one, containing, as it does, the names of Sir J. Donnelly and Sir H. T. Wood, who will deal with the part taken by the Society of Arts in the matter of technical education; Dr. Wertheimer and Mr. Dixon, on subject of examinations; and Prof. Ayrton, Mr. Redgrave and Mr. Macan, on State and legislative interference; Sir J. Fitch, Prof. Thompson, Mr. Slingo and Mr. Turner, on reforms and limitations; Mr. Wells, on the training of teachers; Prof. Garnett, Mr. Hogg and Mr. Sachs, on training bodies; Dr. Armstrong and Dr. Gladstone, on chemical education; Mr. Ablett, on drawing; Mr. King and Mr. Swire Smith, on evening schools; and, on the commercial side, Dr. Wormell, Mr. Webb, Mr. Eve, Mr. Hewins, and Mr. Organ. Sir P. Magnus will speak on theory and practice in trade education, and there will be a series of papers from practical men on the subject of technical education as it affects particular industries and agriculture. There will be a joint Indian paper from Mr. Baines and Mr. Bhownaggree, and one each from seven of our colonies by a man of official position and educational experience in the colony to which the paper relates. The ladies will be represented by the Countess of Warwick, on rural districts; Miss Hughes, on technical education of girls and women; Miss Pycroft and Miss Mitchell, on domestic economy; and Miss Calder and Miss Walter, on domestic science.

The list of foreign papers is, as yet, far from complete; but amongst the contributors from abroad may be mentioned, in addition to those already referred to, Dr. Witt (of Berlin), Prof. Lunge (of Zürich), M. Siegfried and M. Mesureur (of Paris), M. Ed. Séve (of Belgium). Arrangements are being made to enable our foreign visitors and others to become acquainted with the work being done in the matter of technical education, and also for their entertainment. Under the last head may be mentioned the evening reception at the Mansion House, on June 17 (to which the Lord Mayor has kindly invited the members of the Congress), the Society of Arts conversazione on June 16, and an excursion for foreign delegates to be arranged on June 19.

JAMES WYLLIE RODGER, A.R.C.S.

BY the death of J. W. Rodger a young life of great scientific promise has been cut short. He was born at Stewarton, N.B., on December 11, 1867, and was educated at Kilmarnock Academy, under Dr. Dickie, and at the Royal College of Science, London. His college career was interrupted by illness, but he won all the chief prizes, and took a very active part in the management of the college societies. In 1889 he was appointed assistant in the research laboratory, with the result that in the course of the next five or six years a number of papers were published, of which he was joint author with Dr. Thorpe. One of the most important of these, "On the relations between the viscosity of liquids and their chemical nature," was printed in the *Philosophical Transactions*, and was the subject of the Bakerian Lecture in 1894. By a kindly arrangement the lecture was delivered by the younger of the two authors, and no one who was present is likely to have forgotten how well Rodger acquitted himself of his task. It was an admirable piece of exposition. He spoke quickly, but with perfect distinctness; with modesty, but without apparent nervousness or hesitation. Every point was made clear, and at the end it was the general opinion that the Bakerian Lecture had rarely, if ever, been better given than by the youngest Bakerian Lecturer.

A continuation of the work on viscosity, by the same authors, appeared in the *Transactions* in March of the present year.

At the end of 1895 another important paper by Rodger and his friend, Mr. W. Watson, was also published in the *Transactions*. The subject was "The magnetic rotation of the plane of polarisation of light in carbon bisulphide and water."

In addition to these labours Rodger wrote often and well in NATURE and in *Science Progress*, chiefly choosing subjects connected with chemical physics.

Of singularly attractive appearance and manners, popular with his fellows, a good teacher, and a first-rate lecturer, he had done enough solid work to prove that, if life and health were spared, he would win an honourable place in the ranks of English science. But it was not to be. Some time ago serious delicacy of the chest developed, and ten days ago he died before completing his thirtieth year. A. W. R.

NOTES.

AT the annual meeting for the election of Fellows of the Royal Society, held on Thursday last, the candidates whose names and qualifications we have already published (p. 54) were elected into the Society.

THE Vienna Academy of Sciences have elected as foreign members: Profs. Vogel and Bezold of Berlin, Prof. Gegenbaur of Heidelberg, Prof. Max Müller, and Lord Lister.

THE President and Council of the Royal Geographical Society will hold a reception at the Natural History Museum this evening.

THE French Association for the Advancement of Science will hold its twenty-sixth meeting at Saint Étienne on August 5–12, under the presidency of M. Marey.

MR. PERCY S. PILCHER has invited a number of friends and persons interested in aerial navigation to witness one of his experiments with a soaring machine at Upper Austin Lodge, Eynsford, Kent, on Saturday afternoon, June 19.

THE important discovery by two Japanese botanists, of the existence of spermatozoids in certain flowering plants (*Ginkgo biloba* and *Cycas revoluta*), has already been recorded in the pages of NATURE (vol. lv. p. 396). Original preparations, by Prof. Ikeno and Dr. Hirase, illustrating their discovery, will be exhibited by Dr. D. H. Scott, F.R.S., at the next meeting of the Linnean Society, on June 17. This will be the first occasion on which this remarkable observation, obliterating one of the chief supposed distinctions between Phanerogams and Cryptogams, has been demonstrated to European botanists.

THE annual meeting of the Iron and Steel Institute will be held at Cardiff on August 3–6, under the presidency of Mr. Edward P. Martin. A detailed programme will be issued when the arrangements are further advanced.

THE Croonian Lectures of the Royal College of Physicians will be given by Dr. Hale White, at the Examination Hall, on June 15, 17, 24, and 29. The subject of the lectures is "The means by which the temperature of the body is maintained in health and disease."

THE forty-second annual exhibition of the Royal Photographic Society will be held from September 27 to November 13. Negatives, transparencies, photo-mechanical prints, stereoscopic work, photographs of purely scientific interest, and photographs coloured by mechanical means will be admitted to the exhibition, and medals will be awarded by the Judges. Exhibits must reach the Secretary of the Society, 12 Hanover-square, London, W., on or before September 8.

WE regret to have to record the following deaths:—Dr. Julius von Sachs, Professor of Botany in Wurzburg University, and Foreign Member of the Royal Society; M. Slouguinoff, Director of the Physical Institute of the Imperial University of Kazan; Mr. H. B. Chamberlin, who presented the Chamberlin Observatory to Denver University, and in other ways assisted in the advancement of science; Mr. William Godward, formerly of the Nautical Almanac Office, and author of some useful astronomical tables; M. Manen, Correspondant of the Section of Geography and Navigation of the Paris Academy of Sciences; and Baron Oscar Dickson, who fitted out several Arctic expeditions, including the Vega expedition of Baron Nordenskiold.

THE organisation and federation of local scientific societies is a work well worth doing. Prof. Meldola pointed out in these columns a year ago (vol. liv. p. 114) how science would be better served if the efforts of the legion of amateur naturalists were co-ordinated by the formation of groups of societies. The South-eastern Union of Scientific Societies is a group of this character, and the success of the congress which the Union held at Tunbridge Wells towards the end of last month, under the presidency of the Rev. T. R. R. Stebbing, F.R.S., will, we hope and believe, lead to the federation of other local societies. The societies which have joined the Union are almost exclusively natural history societies. They are friendly to philosophy and literature, to mathematics and chemistry, to agriculture and political economy, to astronomy and the use of the globes; but they find their own more special and serious employment in zoology, botany, and geology. What the British Association does on an imperial scale, the Union hopes to do for a limited area. The pursuit of natural knowledge will thus be encouraged, the results of investigations will be made more widely known, and, best of all, public opinion will be enlightened as to the value of scientific work.

NOTHING is worse than fog at sea. A storm may cause discomfort, an accident may cause delay, but in neither case does the traveller feel so helpless as when his vessel is completely shut in by a dense fog. To lessen the danger which then exists, Prof. E. C. Pickering, the Director of the Harvard College Observatory, suggests, in a pamphlet just received, a method of determining the position of a vessel in a fog, based upon the velocity of sound. If two fog-horns of different pitch be placed at equal distances from the middle of a channel or entrance to a harbour, and be sounded simultaneously at regular intervals of about a minute, it will be evident that a captain of a vessel will be able to locate his position with fair accuracy by noting when the sounds of the horns are heard. If the two sounds are heard at the same instant the vessel will be in the middle of the channel, and if they are heard after one another it would be possible to judge from the interval between the two how much the vessel is out of the middle of the channel. For vessels passing one another, Prof. Pickering suggests that each should whistle or blow the horn or syren as soon as the sound is received from the other vessel. Then, if they are five miles apart, each will whistle every fifty seconds, and the distance in miles between the two vessels can always be determined by dividing the interval in seconds by ten. By placing two different fog-whistles on a long steamer, one at the bow and the other at the stern, and arranging that the sounds emitted by both should be heard together by an observer standing at the bow, many collisions might be prevented. Instructions could be given to sailing vessels to keep quiet so long as both signals were heard separately, for they would then be in no danger, but to fire a gun or make other loud noise when both whistles were heard together, for they would then be in front of the steamer. These various methods may be combined indefinitely, and they seem to be worth the consideration of navigators.

AN appeal is being made to iron-masters of the various important iron-making countries for annual subscriptions towards the maintenance of a central laboratory for the testing of iron and steel, to be founded at Zürich under the auspices of the International Society for Testing of Materials of Construction. The Society was founded at a congress held at Zürich in 1895, and none of the tasks which it has imposed upon itself are of greater importance, while none present greater difficulties, than the unification of the methods for the chemical analysis of iron and steel. Efforts have been made in several countries for some years past to lay the foundations of a better knowledge of this subject. But whilst to the fullest extent recognising the very great value of the work already done locally, the Council of the International Society decidedly believes that the work hitherto done in many isolated places should be brought together in a common focus where it would be classified, compared, and reduced to a common standard. Such a central laboratory would also have the task of following the progress of both industry and science, of examining all new methods of any importance brought forward in various quarters, of searching for new methods whenever new problems were presented, and of serving as a guide to the individual chemists when they were beset by the difficulties inseparable from their avocation. Zürich has been chosen as the seat of the institution; and ample accommodation has been secured in the magnificent chemical laboratory of the Federal Polytechnic School. The Federal Council has granted the use of these rooms, free of rent, for the projected central laboratory. Hans von Jüptner, chief chemist of the Neuberg Iron and Steel Works in Austria, has been appointed as the head of the laboratory. 2000*l.* per annum is

required for the maintenance of the laboratory, and it would be impossible to start the laboratory unless this amount was secured for, say, ten years. Looking at the immense importance such a central laboratory is likely to acquire for the whole of the iron industry, and the very large pecuniary benefit ultimately following therefrom, there should not be much difficulty in obtaining promises of subscriptions to the amount required. Mr. Bennett H. Brough, the Secretary of the Iron and Steel Institute, has undertaken to receive subscriptions, and to forward them to the International Society.

FOR a period of about eight years a portion of the staff of the Meteorological Office has been busily engaged in the discussion of observations for the preparation of Monthly Current Charts of the Atlantic Ocean. The observations are contained in about 5500 logs, principally of merchant vessels, collected by the Meteorological Office since the year 1854, and about 13,000 logs kept on board H.M. ships since 1830. The charts for six representative months, referring both to the North and South Atlantic, have been prepared for publication under the superintendence of the Hydrographer of the Admiralty, and are issued in the form of Admiralty charts. They bring to light various interesting points which are masked by charts referring to longer periods; for instance, the Gulf Stream, from which this country is supposed to derive much of its warmth in winter, is shown to flow with varying velocity according to the season, the rate being about 100 miles a day in June, in the Straits of Florida, while in October and November it does not exceed 70 miles a day, and at times only amounts to about 20 miles; and the Guinea and equatorial currents are shown to undergo considerable variations according to the time of the year. Generally speaking, the oceanic circulation can now be studied in a manner that was not possible before the publication of monthly charts, and the results cannot but prove to be of the greatest utility both to seamen and men of science.

MR. H. C. RUSSELL, Government Astronomer of New South Wales, has published, in a recent number of the *Proceedings* of the Royal Society of that colony, a chart showing the tracts of 154 current papers collected during the past two years. The lines plotted on the chart are the shortest tracks between the points where the bottles were thrown into the sea and where they were found. The routes taken by the bottles are interesting: most of them were found on the coast between Melbourne and Adelaide; fifteen were picked up on the east coast of Australia—three of these went to the south, eight went to the north, and four came in from the east. Mr. Russell remarks that, in view of the well-known southerly current on this coast, it is remarkable that so few of the papers seem to go with it, and that the majority of the papers found go against it. The prevailing wind seems to have a decided action in the direction of the drift of the bottles. Three papers, thrown overboard off Cape Horn, followed nearly the same tracks; one was picked up on the west coast of Australia, and the others on the coast of Victoria: their daily rates, over a distance of about 9000 miles, being 9·0 miles, 7·9 miles, and 10·3 miles respectively.

AN interesting collection of prehistoric flint instruments which Mr. H. W. Seton-Karr discovered in Egypt last November, and which he believes to come from the lost flint mines of Egypt, was recently exhibited by him at the Royal Archæological Institute. The collection also included a number of specimens of what Mr. Seton-Karr considers to be the most perfectly preserved palæoliths hitherto discovered. The flint mines are situated in the Eastern Desert of Egypt, some at a distance of about 30 miles from the Nile, some nearer, in the Wady-el-Sheik district. Of palæolithic implements of the earliest date he found but two at the mines. The remainder came from Abydos, Nagada, Nagh Hamadi, Thebes, and other places in the Western Desert. At some of the mines were shafts about 2 feet in diameter, filled up with drifted sand, and surrounded by masses of excavated rock neatly arranged. There was usually a central work-place where most of the objects were discovered. But in some mines a number of clubs or truncheons lay distributed uniformly, as though hurriedly left when the mines were last abandoned, at a period probably long anterior to historic record. The results of Mr. Seton-Karr's sixth and latest expedition were shown in the implements of flint and quartzite from Somaliland. With respect to these discoveries, Sir John Evans remarked in a communication made to the Royal Society, that they "have an important bearing on the question of the original home of the human race. Of their identity in form with some from the valley of the Somme and other places there can be no doubt, and we need not hesitate in claiming them as palæolithic. The cradle of the human race must have been situated in some part of the world where the climate was genial and means of subsistence readily obtained."

IT is depressing to think that there exist not only private persons, but public bodies who put more trust in the wild assertions of charlatans than in the matured conclusions of science. The latest instance of gullibility of this character comes from Bedfordshire. The Urban District Council of Ampthill were ordered by the Local Government Board to procure a water supply within a limited time, the Council being given a free hand how to go to work, and they thereupon unanimously resolved to employ a water diviner. Accepting the recommendations of this gifted gentleman, the District Council applied for a loan to carry them out. But, fortunately for common-sense, when the Government auditor recently sat to audit the accounts of the Urban District Council of Ampthill, several ratepayers raised objections to an expenditure incurred in the employment of the water diviner. They produced geological plans and sections to show that, if the diviner's recommendations were acted on, the Council would be boring into a stratum of Oxford clay, the depth of which had not been fathomed as yet, although a boring had been made to 700 feet, and no water obtained. The auditor, in announcing his decision to disallow the payment, stated that in seeking for water the District Council had disregarded the reports of experts, and had gone for guidance to a man who had a reputation for discovering water by some unusual and peculiar method not possible to ordinary persons, and the question he had to settle was whether this was legal or not. Money might properly be spent on experimental borings under proper advice, but it had not been proved that the diviner employed had any greater power than any one else. It had been held that "the pretence of power, whether moral, physical, or supernatural, with intent to obtain money, was sufficient to constitute an offence within the meaning of the law," and he, therefore, thought that, as the diviner claimed to exercise some such power, his employment was clearly illegal, and the amount of his fee would, therefore, be disallowed, and the gentlemen who authorised the payment surcharged with it. The decision will assist, perhaps, in reducing the number of believers in the water diviner's art.

FOR those men of science who may be induced to travel over Siberia, now that they can do it by rail, we notice that a new interesting museum is being opened at Chita, the chief town of Transbaikalia, in connection with the Transbaikalian Section of the Russian Geographical Society. Rich collections relative to Buryate buddhism, and good collections of objects belonging to natural sciences, archæology, and occurrence of gold in mines, rapidly accumulate in that new little museum, to which a botanical garden is to be annexed.

THIS year's exhibition of the Russian Archæological Commission at St. Petersburg, containing the collections made in the years 1895 and 1896, offers a special interest. Besides a great number of most valuable classical antiquities discovered at the sites of old Greek colonies on the Black Sea, it contains very interesting collections of stone-age implements and pottery from Kieff, Tiflis, and Poland; of the intermediate age between the stone and the bronze period from various parts of Central Russia; and very rich collections of bronze weapons and implements from Caucasia, Saratoff (a splendid bronze helmet), Tomsk, and Yeinseisk. Among these latter the miniature copies of various implements of that period deserve a special mention.

THE last number of the *Journal of the Russian Physical and Chemical Society* (xxix. 3) contains an obituary notice, devoted to the memory of Dr. Véra Bogdanovskaya-Popoff, who was killed on May 8 in her own laboratory at Izhora, by an explosion. She had been working to obtain a combination, analogous to prussic acid, in which nitrogen would be substituted by phosphorus. When Mlle. Bogdanovskaya came to Geneva, in 1890, to study under Prof. Groebe, she intended to carry on that investigation, but was dissuaded by Prof. Groebe, and made, instead, a research on dibenzyl ketone (*Chemische Berichte*, xxv., 1892), for which she received at Geneva the degree of Doctor of Sciences. Returning to Russia in 1892, she was assistant to Prof. Lvoff, at the High Courses for Ladies, and devoted much of her time to aid the beginners in grasping the principles of chemistry. She lectured also upon stereo-chemistry, which she had studied under Prof. Guye; and finally, in her own laboratory in the neighbourhood of St. Petersburg, returned to the work on the phosphorus analogues of prussic acid. She fell a victim of an explosion which took place during that dangerous investigation.

AMONG recent American botanical papers received are "New Studies upon the Smut of Wheat, Oats, and Barley," issued from the Government Agricultural Experiment Station for North Dakota; and the completion of Dr. Millspaugh's "Contributions to the Coastal and Plain Flora of Yucatan," published by the Field Columbian Museum.

THE Deutsche Seewarte has just issued a volume entitled "Segelhandbuch" for the Pacific Ocean, intended to accompany the Atlas of Charts for that ocean, which appeared some time ago. The work is divided into a large number of chapters, written by the staff of the Seewarte and other experts, and contains the results of experience gained by the discussion of an immense number of trustworthy observations, mostly made on board German vessels, relating both to air and sea. The Seewarte has now issued these useful atlases and handbooks for all the large oceans.

IN a recent number of the *Proceedings* of the Boston Society of Natural History Mr. Gerrit S. Miller, jun., gives an account of the mammals of Ontario, based on collections made in different parts of that province in 1896. To these are added notes on the same subject, made by Mr. Allan C. Brooks during ten years' residence in the counties of Wellington and Hamilton. While we fully allow that science is cosmopolitan, it could be well wished that our Canadian friends would pay a little more attention to the fauna of their own country, and not suffer it to be entirely in the hands of their more active brethren of the United States. We trust that the proposed establishment of a Professorship of Zoology at McGill University, Montreal, may have a good effect in this direction.

THE last number of the *Annali d'Igiene Sperimentale* contains a paper by Dr. Massone, on the presence of tubercle bacilli in the milk supplied in Genoa. Forty-four different samples of milk were collected, and were submitted to a careful microscopic examination, but in no case were tubercle bacilli discovered. When, however, the further test was employed of first submitting the various milk samples to the centrifugal machine, and then inoculating the layer of cream and the deposit thus obtained into guinea-pigs, three out of the forty-four samples were found to contain tubercle bacilli, for three of the animals thus treated succumbed to tuberculous infection. Dr. Massone points out how important it is that all tests of milk for tubercle bacilli should be made by direct inoculations into animals, as no trust can be placed on microscopic evidence as to the freedom of milk from this species of infection. In conclusion the author emphasises once more the inconsistency which attends the severe restrictions imposed in many places upon the sale of meat obtained from tuberculous animals, whilst no attention is paid, or public importance attached, to the prevention of milk being distributed infected with these noxious germs. In the former case, owing to the meat being cooked before use, less danger attaches to its consumption, whilst the unfortunate custom which prevails of drinking milk in its raw unsterilised condition, renders the use of contaminated milk a greater menace even to the health of the community than the distribution of tuberculous meat.

EVERYTHING concerning the Island of Jamaica, from its discovery by Columbus in 1494 to the present time, will be found in the admirable "Handbook of Jamaica," published by authority (Mr. Edward Stanford is the London agent), and prepared by Mr. S. P. Musson and Mr. T. L. Roxburgh. At the end of the chronological history of the island, reference is made to the publication of Prof. Williams' report on the cattle disease in Jamaica. The conclusion arrived at is that the disease "is a chronic form of Texan fever conveyed from place to place and transmitted from one animal to another through the intervention of the Tick. The infection is conveyed by the progeny of Ticks which have matured on infected cattle, and is inoculated by them directly into the blood of susceptible cattle." Remedies for the destruction of the Tick are suggested in the report.

THE New Zealand Institute has just commenced to publish, in quarto form, a series of reproductions of photographs of the remaining monuments of Maori skill and art, with short descriptions of the specimens figured. The author of this important descriptive work, Mr. Augustus Hamilton, Registrar of the University of Otago, has, with his camera, visited many outlying parts of Maoriland with great enterprise and success. The pictures obtained by him have been photographically reproduced in extremely fine tone; so that the complete collection will preserve for the ages the characteristics of the ornamentation of the Maoris, when the "devouring tooth of time" has obliterated the originals. It is hardly necessary to explain to readers of NATURE that a publication of this character is of the highest value. The first part, which has just been issued, describes the canoes of the Maoris and the carvings upon them; this, with four other parts illustrating the dwellings, weapons, dress and decoration, and social life, will complete a volume. It is expected that Part ii. will be ready next August.

IN the Catalogue of the Vienna Exchange Office for Cryptogamic Plants, conducted by Herr J. Brunnthaler, Igelgasse 11, Vienna, iv/2, are offered for exchange or sale some 600 Mosses, 140 Hepatics, 940 Fungi, 580 Lichens, 690 Algæ, and 48 microscope slides. The value attached to every specimen is expressed in the units (twentieths of a shilling) adopted for convenience of exchange, the valuation depending on the quality and rarity of the specimen. Numerous regulations are given as to the condition, preparation, and labelling of specimens sent for exchange to the Office. Lists of such specimens as can be supplied for exchange must reach the office by September 15. From the parcels subsequently sent in a deduction of 25 per cent. of the

total value is made for the benefit of the Office. The valuation of European plants is settled by the director, who is willing to receive Vascular Cryptogams and Bacteria in addition to the groups mentioned above. Descriptions of some new species of Fungi are published in the current Catalogue.

DR. RICHARD HERTWIG'S "Lehrbuch der Zoologie," which was reviewed in NATURE in June 1893 (vol. xlviii. p. 173), has reached a fourth edition. The section on the Sporozoa has been revised, and some additions have been made in the section on the Vertebrates. The work is published by Gustav Fischer, Jena.—Messrs. Blackie and Son have published what is nominally a fourth edition of Mr. Jerome Harrison's "Text-Book of Geology"; but the additions and changes are so numerous that the work is practically a new one, the type having been entirely re-set. The book is "intended as an introduction to the study of rocks and their contents," and it will, we believe, be the means of adding to the number of out-door students of geology, notwithstanding the fact that it belongs to the class of examinational text-books. The text is clearly printed, and the illustrations are numerous and generally instructive.—Messrs. J. and A. Churchill have published the second edition of "A Manual of Botany," by Prof. J. Reynolds Green, F.R.S. Very few changes have been made in the work.

WE have upon our table a number of important geological memoirs and reports lately published. Geologists will be glad to have their attention drawn to these publications. From the Geological Survey of India we have received the first memoir of a new series (Series xvi.) of the Palæontologia Indica, intended to comprise a description of the fossils found in Baluchistan. The first part of the new series comprises the Jurassic Fauna of Baluchistan, and in the present memoir, Dr. Fritz Noetling deals with the fauna of the Kellaways of Mazár Drik. The geology of the Bellary district, Madras Presidency, is described by Mr. R. Bruce Foot in vol. xxv. of the memoirs of the Survey; and the geology of Hazara and the Black Mountain is dealt with by Mr. C. S. Middlemiss in vol. xxvi. of the same memoirs. Both of these papers are full of details referring to the geology of the district surveyed by the authors, and each of them throws light upon problems of more than local interest.

A REPORT on explorations in the Labrador Peninsula along the East Main, Koksoak, Hamilton, Manicuagan, and portions of other rivers, made by Mr. A. P. Low in 1892-95, has been published by the Geological Survey of Canada (Part i., Annual Report, vol. viii.). This is an interesting account of exploration, containing much new information in regard to the geology and natural history of the Labrador Peninsula. A concise and readable summary of the observations made, and the conclusions reached from them, takes up one part of the report, and the remainder consists of detailed descriptions of the routes, the rocks noted, and other observations for the use of future explorers in the region traversed. Lists and notes on the fauna and flora of Labrador, and a meteorological record are printed as appendices to the report. We have also received Part R of the same annual report (vol. viii.) containing an account of the work carried out in the Laboratory of the Survey during 1896, by Dr. G. C. Hoffmann. In this report reference is made to several interesting and, in some instances, valuable minerals, not before known in Canada. Two other recent publications of the Geological Survey of Canada are: "Report on the Country between Athabasca Lake and Churchill River," by Mr. J. Burr Tyrrell, assisted by Mr. D. B. Dowling; and "Palæozoic Fossils," by Mr. J. F. Whiteaves. The latter paper is the third part of the third volume on Palæozoic Fossils now in course of publication by the Canadian Survey.

THE twenty-second and twenty-third annual reports of the Geological and Natural History Survey of Minnesota, referring to the work done during 1893-94, have been received from the State Geologist, Mr. N. H. Winchell. The latter report contains a paper by Mr. Winchell on "The Origin of the Archean Greenstones." The paper is a critical examination of a paper by Dr. G. H. Williams, tending to the conclusion that the greenstones, as a body, may be referred to dynamic metamorphism of massive eruptive rocks. Mr. Winchell believes "that the great bulk of the 'greenstones' as an Archean terrane, ought to be classified as pyro-clastic, *i.e.* that they originated from eruptive agencies, as tuff and all kinds of volcanic débris, sometimes very coarse, and were distributed and somewhat stratified by the waters of the ocean into which the materials fell."

THE additions to the Zoological Society's Gardens during the past week include two Vervet Monkeys (*Cercopithecus lalandii*, ♂ ♀), two Crested Porcupines (*Hystrix cristata*) from South Africa, presented by Mr. J. E. Matcham; a Brown Bear (*Ursus arctos*), European, presented by Mr. William Forbes; a Black-necked Grackle (*Gracupica nigricollis*) from China, presented by Mr. B. H. Jones; a Ring-necked Parrakeet (*Palæornis torquata*) from India, presented by Mrs. Doyne; five Common Chameleons (*Chamæleon vulgaris*) from Egypt, presented by Dixon Bey; a Ring-tailed Lemur (*Lemur catta*), two Black-headed Lemurs (*Lemur brunneus*) from Madagascar, two Korin Gazelles (*Gazella rufifrons*, ♂ ♀) from Senegal, a Fennec Fox (*Canis cerdo*), six Egyptian Foxes (*Canis niloticus*), a Pale Genet (*Genetta senegalensis*), three Leith's Tortoises (*Testudo leithi*) from Egypt, a Harnessed Antelope (*Tragelaphus scriptus*, ♀) from West Africa, deposited; a Californian Sea Lion (*Otaria californiana*, ♀) from the North Pacific Ocean, two Ostriches (*Struthio camelus*, ♂ ♀) from Africa, purchased; a Long-legged Jackal (*Canis variegatus*) from North-east Africa, three North African Jackals (*Canis anthus*), a Striped Hyæna (*Hyæna striata*) from Egypt, received in exchange; an Eland (*Orias canna*, ♂), a Patagonian Cavy (*Dolichotis patachonica*), born in the Gardens.

OUR ASTRONOMICAL COLUMN.

THE LATITUDE OF THE ROYAL CATANIA OBSERVATORY.—The Italian Royal Geodetical Commission have just published a detailed account of the determination of the latitude of the Royal Astronomical Observatory of Catania by Dr. T. Zona, of the Royal Observatory of Palermo. All the observations were made during the year 1894, and the method adopted was that of Talcott. The pairs of stars used amounted to twenty-three in number, and their places were obtained from each of the three separate catalogues, viz. Respighi, Bradley-Auwers, and the British Association Ten-Year.

Dr. Zona has not attempted to amalgamate the positions of each star as given by the three separate catalogues, by using a mean value, but has preferred to determine three values for the latitude, basing each on the separate catalogue star positions for the pair employed.

In this way computation has given for the final values of the latitude, based on the star positions of each catalogue, the following results:—

Respighi	37° 30′ 13″·239 ± 0″·115
Bradley-Auwers	13·216 ± 0·132
Ten-Year	13·302 ± 0·108

The final value adopted for the latitude of the transit instrument of the observatory was

37°·30′·13″·254 ± 0″·068.

PHYSICAL AND MICROMETRICAL OBSERVATIONS OF VENUS.—The amount of detail visible on the disc of Venus is not so very prominent, according to the observations recently recorded by Prof. Barnard (*Astrophysical Journal*, vol. v. No. 5). Those observers who up to the present time have only made out dusky

patches on her surface will feel satisfied that this well-known observer has not yet detected such tracings as have been put before us by Lowell. Venus was frequently observed by him with the 12-inch refractor of the Mount Hamilton Observatory during the years 1888–95, but as he says he "never could (with but one exception) satisfactorily see the markings. Vague indefinite spots were often visible, but it was not possible to see them well enough to identify them for rotational purposes." With these facts before us, it is not then surprising that the observed periods of the planet should vary from twenty-three or twenty-four hours to 225 days. The exceptional case of good seeing mentioned above was "when the air was thick with smoke and dust. . . . I was struck with the remarkably perfect definition. There was not the slightest tremor. The markings on the surface of the planet were distinctly seen, though they were difficult and very delicate." The drawing which accompanies Prof. Barnard's description shows the crescent of Venus with four large hazy patches very much foreshortened in their position near the limb.

To continue his series of measurements of the diameters of all the planets with the 36-inch, Prof. Barnard, in May, June and July of 1895, undertook that of Venus. The mean of all his measures reduced to unit distance gave a diameter of 17″·397, corresponding to an actual diameter of 7826 miles.

This value seems to be very satisfactory when compared with the mean of all previous determinations, as will be seen in the following table.

Hartwig ...	Breslau heliometer	17″·67
,, ...	Reduction of Oxford measures ...	17·582
,, ...	Double image observations by Kaiser	17·409
,, ...	Nine measures in Bahia-Blanca ...	17·406
Peter ...	Two measures in Bahia-Blanca ...	17·216
Küstner ...	Two measures in Punta Arenas ...	17·312
Auwers ...	Measures during transit	16·801
Ambronn...	Göttingen heliometer	17·711
	Mean	17·389
Barnard...	36-inch Lick refractor...	17·397

NEBULÆ UNRECORDED IN CATALOGUES.—In the current number of the *Observatory*, Dr. Roberts gives a list of several nebulæ which have not found a place in catalogues, but which have been recorded on the plates used in his photographic survey. These photographs were taken with his fine 20-inch reflector at Crowborough, and a comparison between these and the recorded places of nebulæ in the "New General Catalogue," and the "Index Catalogue," by Dr. Dreyer, has been fruitful of many discoveries. Of the seventeen new nebulæ, we extract the following description of the largest :—

Region of ♅ I. 157 Trianguli, N.G.C. 672; Nova, R.A. 1h. 39m. 39s. N.P.D. 63° 22′·3.—It is nearly as large and prominent as ♅ I. 157, and distant from centre to centre 8′ only; nucleus consists of six faint stellar condensations forming a straight line in the direction south, following to north preceding, and there are six or seven very faint condensations of nebulosity near the preceding margin; 15th mag. star on the north preceding margin, and a 16th mag. star at the south following end of the nucleus, 1896 November 29.

It is remarkable that this object should have escaped detection by the many keen-eyed observers who have examined the nebula ♅ I. 157, which is only four minutes of arc distance from it; and it appears to me that we are justified by the evidence in inferring that this nebula has come into the state of visibility during the past half-century. Lord Rosse, in 1896, made several observations of the nebula adjoining, but does not refer to this one. It is remarkable also that the nuclei of the two nebulæ are straight lines of faint nebulous stars immersed in nebulosity, and they are so clearly depicted on the photograph that I think they should be visible to the eye by the aid of telescopic power.

Dr. Roberts finds further, by examining his negatives, that two classes of stars, which he terms "faint" and "small," attract notice. The former have small bright nuclei surrounded by nebulosity, and are quite distinct from the latter, which appear as small round spots without a nucleus. These, he states, would, if they were classified, come under the heading, "small circular nebulæ with small bright stellar nuclei."

HARVARD COLLEGE OBSERVATORY ZONE OBSERVATIONS.—Volume xxxvi. of the *Annals* of the Astronomical Observatory of Harvard College contains the journal of the zone observations of stars between 49° 50′ and 55° 10′ of North Declination. These observations were made with the meridian circle during the ten years 1875 to 1885 by Mr. William Rogers, under the direction of the successive directors Joseph Winlock and E. C. Pickering. The present volume completes the journal begun in volume xxxv., and in this review all doubtful cases have been re-examined.

THE ROYAL OBSERVATORY, GREENWICH.

THE Astronomer Royal presented his annual report on Saturday last to the Board of Visitors of the Royal Observatory, Greenwich. Among the numerous guests were many astronomers and men of science, who inspected the buildings and instruments, especially those which have been erected since the visitation last year, namely, the Thompson equatorial and the new altazimuth. The following extracts from the report contain a brief *résumé* of the year's work.

Buildings.

The building of the north wing and central dome of the Physical Observatory was finished in September 1896, with the exception of the vane on the central dome, which was completed last March.

An observing floor and gallery have quite recently been fitted up in the dome to facilitate work with the new Thompson equatorial, now mounted there. The completion of the Physical Observatory by the building of the east and west wings has been further delayed, though provision was made for commencing the work in the last financial year.

The Transit Circle.

With regard to this instrument, it has been found that the apparent correction for discordance between the nadir observations and stars observed by reflexion has been gradually increasing yearly, the difference for the present year being −0″·44, the greatest negative value recorded since 1888.

The increase in this discordance in 1896, following on the systematically negative values since 1891, led to a re-examination of the screws of the microscope-micrometers, of the screw of the telescope-micrometer, and of the errors of those divisions of the circle which are used in observations of the nadir, with a view to the discovery of the source of this discordance.

The microscope-micrometers showed signs of wear, but the reversal of three of the screws has successfully eliminated the effect of wear from the mean of the six microscopes.

The New Altazimuth.

This instrument was erected in May 1896, but it was not practicable to make observations with it till the completion of the observing floor in September. It was then found that there were serious discordances in the readings of the circles under the different microscopes, depending on the direction in which the instrument was last turned. Experiments indicated flexure in the axis, which has now been corrected by stiffening the axis by means of a strong diaphragm of special form fitted in the central part of the axis. The friction-rollers for taking the weight of the instrument have also been modified, the position being changed to bring them close to the pivots, and a system of levers has been substituted for springs. These changes reduced the discordances greatly in amount. Quite recently Mr. Simms has discovered a cause of error, arising from a tendency in the pivots to act as a screw, a longitudinal force being thus introduced, its direction depending on the direction in which the telescope is turned. This force had the effect of slightly moving the iron standards carrying the bearings and the microscopes, thus changing the position of the microscopes relatively to the graduated circles. This action of the pivots was found to arise from the method adopted in grinding them of giving a helical twist to the grinder, and it was cured by a few circular turns of the same tool.

The Thompson Equatorial.

This new instrument, presented by Sir Henry Thompson, forms a handsome addition to the Observatory, and it has been mounted in the Physical Observatory under the Lassell Dome. Its erection there was commenced early in November, but it was not ready for use till April, and there are still certain accessories which have to be supplied. The adjustment of the polar axis and of the 26-inch object-glass were at once taken in

hand, and the former was soon satisfactorily effected. For the adjustment of the object-glass a number of photographs have been taken inside and outside of the focus, the separation between the lenses being varied with a view to the correction of the small outstanding aberration and coma. Some photographs of the moon and of double stars have been taken, an enlarging camera with a Dallmeyer concave magnifier being applied to the telescope in some cases to give a magnified image. This equatorial carries not only the 26-inch photographic telescope with the 12¾-inch Merz guiding telescope and the Thompson 9-inch photoheliograph, but also a Cassegrain reflecting telescope of 30 inches aperture with the 6-inch Hodgson telescope as guider in place of the counterpoise at the other end of the declination axis. It thus provides a very powerful combination of telescopes specially adapted to photographic work of various kinds, and special arrangements in the instrument and observing room have been necessary to meet the varied requirements. The instrument has now been got into good working order, and is very satisfactory as regards the mechanical arrangements. The photographic spectroscope will be used in connection with the Cassegrain reflector mounted firmly at the back of the cell of the mirror, a diagonal prism being used to reflect the rays into the collimator.

The 28-inch Refractor.

This instrument was in constant use for micrometric measurements from 1896 May 11, to 1897 January 11. On January 12 the crown lens was reversed, and the instrument used for photography till April 23, except on the occasion of Prof. Barnard's visit to the Observatory, when the lens was replaced in the visual position. Besides several micrometric observations, 195 double stars were measured during the year ending May 10. The distance and position-angle of the satellite of Neptune were measured on four nights, and the equatorial and polar diameters on two nights. The equatorial and polar diameters of Mars were measured on seven nights. With the crown lens in the reversed position, a number of photographs was taken in and out of focus for the better adjustment of the separation of the lenses and the tilt.

The Astrophysical Equatorial.

The following statement shows the progress made with the photo-mapping of the heavens :—

	For the Chart (exposure 40m.).		For the Catalogue (exposures 6m., 3m. and 20s.).
Number of photographs taken	175	...	139
,, successful plates ...	135	...	110
,, fields photographed successfully...	133	...	98
Total number of successful fields reported 1896, May 10 ...	490	...	732
Number of photographs, previously considered successful, rejected during year ...	72	...	16
Total number of successful fields obtained to 1897 May 10 ...	551	...	814
Number still to be taken ...	598	...	335

Of the fields still required 197 are within 10° of the Pole, and no photographs of this part of the sky have yet been taken, the work being purposely deferred till near the epoch 1900.

Spectroscopic and Heliographic Observations.

Photographs of the sun were taken on 222 days, and of these 471 have been selected for preservation, besides twelve photographs with double images of the sun for determination of zero of position-angle.

For the preceding year Greenwich photographs were selected for measurement on 206 days, and photographs from the Solar Physics Committee (filling up the gaps in the series) on 154 days, making a total of 360 days out of 366 on which photographs are available.

The spot activity of the sun has continued on the whole to decline since the date of the last Report, but has undergone two remarkable cases of temporary revival; the one in September 1896, when the longest connected group ever photographed at Greenwich was observed, and the other at the commencement of the present year. On the other hand, the sun was seen to be free from spots on six days in the year ending 1897 May 10.

Magnetic Observations.

The variations of magnetic declination, horizontal force and vertical force, and of earth currents have been registered photographically, and acccompanying eye observations of absolute declination, horizontal force and dip have been made as in former years.

The principal results for the magnetic elements for 1896 are as follows :—

Mean declination ...	16° 56′·5 West.
Mean horizontal force	3·9834 (in British units). 1·8367 (in metric units).
Mean dip	67° 8′·5 (by 9-inch needles). 67° 9′·3 (by 6-inch needles). 67° 10′·0 (by 3-inch needles).

These results are to a certain extent affected by the iron in the new Physical Observatory, and in the new Altazimuth Pavilion.

The selection of the site for the new Magnetic Pavilion required much consideration and necessitated observations at a number of stations in Greenwich Park. As the result of the survey it was decided to abandon a site which had been provisionally selected at a distance of about 250 feet to the east of the reservoir, and to choose another at a considerably greater distance both from the reservoir and the Observatory.

Meteorological Observations.

The mean temperature of the year 1896 was 50°·1, being 0°·7 above the average for the fifty years 1841–1890.

During the twelve months ending 1897 April 30, the highest daily temperature in the shade recorded on the open stand was 91°·1 on July 14. The highest reading recorded in the Stevenson screen was 87°·6. Under the same conditions of exposure on the open stand there have been twenty-six instances of temperatures exceeding 90° recorded in the preceding fifty-five years, the highest having been 97°·1 on 1881 July 15. The temperature rose twice above 90° in 1896, and seventeen times above 80°. The monthly mean temperatures for June, July, February and March were respectively above the corresponding averages by 4°·0, 2°·8, 3°·5 and 3°·3; and the means for August, October, November and January were in defect by 2°·5, 3°·5, 2°·7 and 3°·1. The mean temperature for the twelve months 1896 May to 1897 April was 49°·7, being 0°·2 above the fifty years' average.

In the winter months of 1896–1897 there were forty-two days on which the temperature of the air fell to the freezing-point, or below; sixteen of these days occurring in January, and eleven in December. The lowest winter temperature was 23°·8 on 1897 January 18, as compared with 24°·3 in the preceding winter.

The number of hours of bright sunshine recorded during the twelve months ending 1897 April 30 by the Campbell-Stokes instrument (with the old ball up to December 31, and with the new ball after), was 1152 out of the 4454 hours during which the sun was above the horizon, so that the mean proportion of sunshine for the year was 0·259, constant sunshine being represented by 1. This amount is probably too small for reasons stated in the report.

The rainfall for the year ending 1897 April 30 was 26·83 inches, being 2·29 inches above the fifty years' average. The number of rainy days in the twelve months was 178.

Personal Establishment.

In the last Report mention was made regarding the reorganisation of the staff. The arrangement now adopted is that Mr. Dyson and Mr. Cowell have the general superintendence of all the work of the Observatory, Mr. Dyson taking special charge of the astronomical department, and Mr. Cowell of the astrophysical department, in which is included the magnetic and meteorological branch. Mr. Maunder is charged with the heliographic photography and reductions. Mr. Lewis has charge of the time-signals and chronometers, and of the 28-inch equatorial. Mr. Thackeray superintends the miscellaneous astronomical computations and meridian zenith-distance reductions. Mr. Hollis has charge of the photographic mapping of the heavens, the measurement of the plates, and the computations for the astrographic catalogue. Mr. Crommelin undertakes the altazimuth and Sheepshanks equatorial reductions, and Mr. Bryant the transit-reductions and time-determinations. In the magnetic and meteorological branch, Mr. Nash has the charge of the whole of the work.

INSECTS AFFECTING DOMESTIC ANIMALS.[1]

THIS work is one of the most recent of the many valuable publications on economic entomology for which we are indebted to the Department of Agriculture of the United States, and is a well-printed and well-illustrated volume of about 300 pages, giving, firstly, an enormous amount of useful information on the histories and means of prevention of insects injurious to wild and domesticated animals, and also to man. Following on this are about sixty pages devoted to the wingless parasites, classed scientifically in the sub-order *Mallophaga* more shortly here as "biting lice"; and a further division, of about twenty-five pages, gives under the heading of *Arachnida* some of the most important representatives of the "mites, ticks, scab insects, mange insects, &c."

The value of the book is much enhanced by the excellent supply given of explanatory adjuncts, including in these a very full table of contents, with number of page bracketed to name of each insect or parasite; also an introduction dealing mainly with points of entomological classification, distribution of the pests, as to the divisions of mammals, birds, &c., affected by them, and "Effects of Parasites on the Host, &c."

The body of the book is followed by "A List of Parasites according to Hosts"; several pages with titles of works more especially bearing on the infestations previously entered on, together with the names of their authors, and a good index completes the useful volume.

In the "letter of transmittal" of the work to the U.S. Secretary of Agriculture, it is noted by Dr. L. O. Howard, Entomologist to the Department, that "the Report will form an excellent text-book of the subject, and is a work which in the opinion of the writer should be in the hands of all stock raisers." This, of course, refers primarily to stock raisers of the United States; but even on our side the Atlantic, from the plainness of the descriptions, both of infestations and remedies, the information will be of much practical use, and also as a scientific as well as practical manual should be in the hands of all our economic entomologists.

The book may be considered as in some degree a legacy, or posthumous contribution by the late Prof. Riley to the work of economic entomology, which he had so much at heart, as we are told in the "Prefatory Note" that the report was originally planned in 1885 as a conjoint work with Dr. C. V. Riley, and it is matter of congratulation that the plans have fallen in their completion into such very well-qualified hands as those of Prof. Osborn.

The accounts of the infestations consist, for the most part, of plainly-worded descriptions of the insects (suitable for general

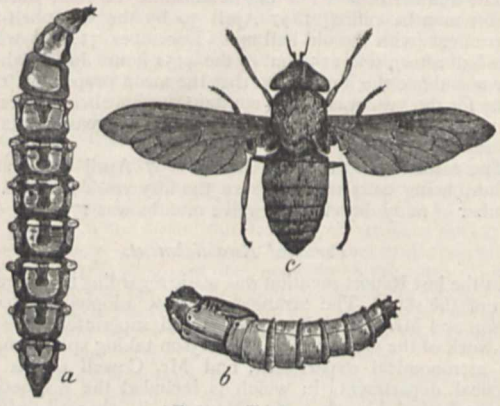


FIG. 1.—*T. atratus.*

use), with notes of habits, distribution, or other points of interest, and measures of prevention and remedy. The figures are clear and good, and that at p. 61, of "The Black Gad Fly" (*Tabanus atratus*), after Prof. Riley, gives a good example of method of representation of the insect in all its stages (Fig. 1). The figure at p. 118, of a cow's horn with the base covered with the clustering masses of the "horn fly" (*Hæmatobia serrata*), gives a guide to the appearance of the infestation *in situ*, unmistakable by the most superficial observer (Fig. 2). A single extract from

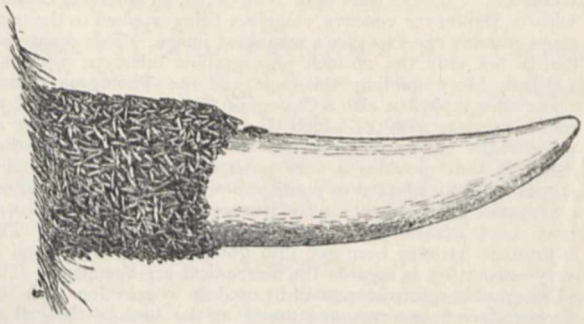


FIG. 2.—Infested cow's horn.

the table of contents may serve as a specimen of the completeness with which the work is given.

"Family SIMULIIDÆ (black flies, buffalo gnats). Losses from buffalo gnats (p. 32)—Life-history and habits (p. 33)—Preventives (p. 36)—Remedies for the bites (p. 37)—Natural enemies of buffalo gnats (p. 38)—Descriptions of species with notes on their habits (p. 38)—The Columbacz midge (p. 38)—*Simulium ornatum* (p. 39)—The black fly (p. 40)—The Southern buffalo gnat (p. 41)—The Turkey gnat (p. 52)—The Western buffalo gnat (p. 55)—*Simulium piscicidium* (p. 56)—*Simulium canescens* (p. 57)—*Simulium rivulara* (p. 57—*Simulium* sp., in Brazil (p. 57)—*Simulium venustum* (p. 57)—*Simulium* sp., near Washington (p. 58)—*Simulium pictipes* (p. 58)." E. A. O.

THE ENGWURRA, OR FIRE CEREMONY OF CERTAIN CENTRAL AUSTRALIAN TRIBES.[1]

AMONGST certain tribes inhabiting the centre of Australia, the last of the initiation ceremonies through which every man must pass before he is fully admitted to all the sacred mysteries of the tribe, takes the form of a series of what may be called ordeals by fire. Some such ceremony is known to us to exist amongst the Urabunna tribe, in the neighbourhood of Lake Eyre; in the Arunta tribe, which extends across the centre of the continent to about seventy miles north of the Macdonnell Range; and also in the Ilparra and Warramunga tribes, who extend at least two hundred miles still further to the north.

We cannot fully translate the term Engwurra, or Urrumpulla, by which the rite is known in certain parts, but each of them is formed in part of the word *ūrra*, which means fire. The Arunta natives say that the ceremony has the effect of strengthening all those who pass through it. It imparts courage and wisdom, makes the men more kindly-natured, and less apt to quarrel; in short, it makes them *ertwa mūrra oknirra*, words which respectively mean, in the Arunta tongue, "men, good, very, or great."

Evidently the main objects of it are, firstly, to bring the younger men under the control of the elders, whose commands they have implicitly to obey; secondly, to teach them habits of self-restraint and hardihood; and thirdly, to show to the younger men who have arrived at mature age, the sacred secrets of the tribe, especially those which are associated with the totems.

The Engwurra is the fourth of the initiatory rites through which every Arunta native has to pass. Of two of the three earlier ones the details have already been described by one of us,[2] and, stated briefly, the ceremonies are as follows. At the age of about ten or twelve the boys are taken to a spot close to the main camp, where the men and women assemble. Whilst

[1] "Insects affecting Domestic Animals: an Account of the Species of Importance in North America." By Herbert Osborn, Professor of Zoology and Entomology, Iowa Agricultural College, Ames, Iowa. Bulletin No. 5, New Series, U.S. Department of Agriculture, Div. of Entomology. (Washington: Government Printing Office, 1896.)

[1] The paper, of which this is an outline, was read before the Royal Society of Victoria, in April, by Prof. Baldwin Spencer and F. J. Gillen, Sub-Protector of Aborigines, Alice Springs, South Australia.

[2] F. J. Gillen, in "Report on the Work of the Horn Exped. to Cent. Aust." Part iv., "Anthropology," p. 169. Plates 16, 17, 18.

the women dance round, the men toss the boys in the air and catch them as they fall.

This over, they are painted on the back and chest with straight or curved bands outlined by red or yellow ochre lines, the painting being done by a man who stands in the relationship to the boy of brother to a woman whom it will afterwards be lawful for him to take as wife. The boy is told that this ceremony will promote his growth, and that the time has now come when he must no longer play with, and live at the camp of, the women and children, but must go to that of the unmarried men, and live with them. He begins to accompany the men in their hunting expeditions, listens to their talks around the camp fire at night, and looks forward to the time when he shall be admitted to the privilege of manhood.

Some years elapse before the second ceremony is performed. When he arrives at puberty, or possibly not till some time later, the rite of circumcision is practised; and a short time after this, there follows the third rite—that of sub-incision. When he has passed through these three ceremonies, the native is admitted to the ranks of the men; he may wear a hair girdle round his waist, tie his hair back with the forehead-band, and may take a wife.

The different periods of his life are indicated by different terms. When a mere child, he is Amba-querka; after having been thrown up, he is Ulpmerka; after circumcision, he is Arrakurta; after sub-incision, he is Ertwa-kurka; and finally, when he has passed through the Engwurra, he becomes an Urliara.

The Engwurra ceremony, which the authors witnessed, was held amongst the Macdonnell Ranges, in the vicinity of Alice Springs telegraph station on the overland telegraph line between Adelaide and Port Darwin. Of this station one of the authors is officer in charge; and his long acquaintance with the natives, as well as the fact that he is Sub-Protector of the Aborigines, has given him special facilities for gaining their confidence.

The ceremony lasted four months, commencing in September 1896, and ending in January 1897; and during this period the authors spent the greater part of the time in the native camp, being allowed to witness everything which took place—being, in fact, regarded as members of the tribe.

The spot chosen for the ceremony was a level stretch of ground, hemmed in on one side by a range of rugged quartzite, and on the other by the River Todd, which, like all other Central Australian rivers, is, except at rare intervals, a dry tract of sand bordered by steep banks on which grows a fringe of gum-trees and low scrub. This level flat formed the Mirra Engwurra, or Engwurra Camp. The women's camp was out of sight on the other side of the river; for, needless to say, the women and uninitiated were not allowed to go anywhere near to the sacred ground.

The natives are summoned to the Engwurra by messengers sent out by the old man who presides at the ceremony. There may be one or more messengers, and each carries one or two of the sacred sticks or Churinga wrapped up from sight in emu feathers, the Churinga being of the nature of the objects commonly called bull-roarers. The messenger who summons to the Engwurra is called *Ilchinkinja*, the word being a compound of *ilcha*, hand, and *inkinja*, to lift up, and may be translated by the term "the beckoning hand." The significance of the Churinga will be seen shortly; meanwhile it may be said that in their natural state no native dare disobey such a summons, through fear of the harmful consequences which would befall him if he did so.

Representatives of the different local groups of the Arunta tribe assembled early in September, each group bringing with it stores of its sacred Churinga, which were under the careful charge of the elder men.

Before going further, it is necessary to allude briefly to the organisation of the tribe. Its division into exogamously intermarrying phratries or classes has been already clearly shown by Messrs. Howitt and Fison, and later by Messrs. Gillen and Stirling. There is little doubt but that originally there were two main phratries, each of which became divided again into two, whilst at the present day the division has been, or rather is now being, carried still further, with the result that instead of four, we have eight sub-phratries. This division into eight exists in reality throughout the tribe; but it is only amongst the northern groups that there are separate names for each of them, and it will be simpler here to deal with the four which are found throughout the tribe. The names of these four are Panunga, Bultharra, Purula and Kumarra. One moiety of the tribe consists of the first two, the other of the second two. The marriage arrangements are as follows:—

Bultharra (male)	marries	Kumarra,	children are	Panunga.
Panunga	,, ,,	Purula,	,, ,,	Bultharra.
Purula	,, ,,	Panunga,	,, ,,	Kumarra.
Kumarra	,, ,,	Bultharra,	,, ,,	Purula.

Every Bultharra man, for example, must marry a Kumarra woman, that is, one who comes from the moiety of the tribe to which he does not belong, and their children, go into the man's moiety, but into the sub-phratry to which he did not belong. At the same time the Kumarra women are divided into two sets, owing to the social organisation—details of which will subsequently be published by the authors—and these two sets stand respectively to each individual Bultharra man in the relationship of what is called Unawa and Unkulla, and it is only the former who are eligible to him as wives. In just the same way the Bultharra men are divided into two sets, who stand respectively to any Kumarra woman in the relationship of Unawa, whom she may marry, and Unkulla, whom she may not.

There can be no doubt whatever about the fact that the Panunga and Bultharra form one moiety, and the Kumarra and Purula another. This is shown in various ways, and when large numbers of the natives are gathered together at such a ceremony as the Engwurra, it stands out most clearly. Not only are there two main camps on the Engwurra ground, at one of which the Panunga and Bultharra gather, and at the other the Purula and Kumarra, but the sacred Churinga are deposited in two separate spots, those of the Panunga and Bultharra being placed, during the Engwurra which the authors witnessed, on a platform erected in a Mulga tree on the hill-side, overlooking at one end the ceremony ground, whilst those of the Kumarra and Purula were placed on a small platform at the opposite end.

As soon as the natives had begun to assemble, the Alice Springs blacks, in whose locality the ceremony was to be performed, opened the proceedings by performing two corrobborees, or ordinary dancing festivals, which occupied the evenings of the first three weeks, and at which, as they are not sacred, the women are allowed to be present, and to take part.

Before these were finished, the old man presiding over the Engwurra went to the chosen ground, and there raised a small mound of earth about forty feet long, one foot high, and two feet across, planting all along it small boughs of Eucalyptus. This mound is called the Parra, and apparently represents a tract of country. When this was done, the older men, who had already passed through the ceremony, and had thus become Urliara, together with the younger men, about forty in number, and varying in age from twenty to thirty-five, or even forty, who were to be made Urliara, spent the whole time during the ensuing two and a half months in the performance of sacred ceremonies on the Engwurra ground. Every day a certain number of young men are sent out to hunt for game, but from this time forward until the end of the whole ceremony they are not supposed to go near the women's camps. They must sleep at night on the Engwurra ground, and are completely under the control of the older men, whose orders they must implicitly obey.

The sacred[1] ceremonies, of which the authors witnessed the performance of about sixty, were all concerned with the numerous totems into which the members of the tribe are divided, and the special object of the authors was to gain an insight into the totemic system, and in connection with this to arrive, if possible, at a correct knowledge of the significance of the Churinga. These Churinga, or sacred sticks and stones,[2] are the most valuable possession of the Arunta natives, and throughout the tribe they are stored in considerable numbers in special hiding-places, the exact locality of which is only supposed to be known to the older men of each local group in whose district they are preserved. The whole tribe is divided up into a large number of such local groups, who reside in and are regarded as the proprietors of a definite tract of land, and each of the latter is especially associated with the name of some object, which is usually that of an animal or plant, and is, in fact, the totem of

[1] The term sacred is used to distinguish them from the ordinary ones, such as the dancing festivals, commonly called corrobborees, which any one, women and children included, may witness, whilst the sacred ones may only be seen by initiated men.

[2] Remarks upon and drawings of some of these will be found in the work by Messrs. Gillen and Stirling, previously alluded to. Therein Mr. Gillen supplied the information that they were symbolic of the totems, which may be modified now by saying that each Churinga is symbolic of an individual belonging to a particular totem.

the majority of individuals who occupy that particular area. The whole country occupied by the Arunta—and the same is true of other tribes of which the authors have information—is divided up into a large number of parts, each comprising what the natives call an *Oknannikilla*, which may be described as a local totem centre. There are, for example, certain areas forming wild cat oknannikillas, others emu, kangaroo, mulga, frog, and so on, the exact position of which is known to the natives.

If, on the other hand, we examine the Urabunna tribe, which adjoins the Arunta on the south, we see clearly a fundamental difference in regard to the totemic system. The Urabunna are divided into two phratries, viz. Matthurrie and Kirarawa, and each of these again into certain totems, the same totem not occurring in both phratries. The organisation of the tribe is such that a Matthurrie man must marry a Kirarawa woman, and not only this, but there is the further restriction that a man of one totem must marry a woman of another. Thus a Matthurrie cricket man must marry a Kirarawa crow woman, and, as descent is counted through the mother, and not, as in the Arunta, through the fatner, the children are Kirarawa and crows.

In the Arunta it is quite different, and so far as the totems are concerned, at first sight most perplexing. The subphratry name is simple, every child of a Bultharra man and a Purula woman is a Panunga, and so forth, but there is no such orderly method in the totem names. The following actual examples of three, amongst many families investigated by the authors, are typical of what is found through the tribe.

In the first family the father is Hawk ; wife No. 1, Bandicoot ; daughter, Witchetty Grub ; wife No. 2, Kangaroo ; no children ; wife No. 3, Lizard ; two daughters, one Emu, the other Water.

In the second family the father is Witchetty Grub ; wife No. 1, Lizard ; no children ; wife No. 2, Munyeru (grass seed) ; two daughters, one Lizard, the other Witchetty Grub.

In the third family the father is Eaglehawk ; wife No. 1, Hakea flower ; no children ; wife No. 2, Hakea flower ; three sons, respectively Witchetty Grub, Emu, Eaglehawk ; two daughters, each Witchetty Grub.

Two things are clear, first, that the totems, as they now exist, have nothing to do with regulating marriage ; and second, that the totems of the children do not of necessity follow either that of father or mother ; they may be identical with either or both of them, or they may be entirely different.

It was whilst watching the ceremonies during the Engwurra, and questioning carefully the performers after each one was concluded, that the authors were able to gather information explaining this apparently perplexing system, and also to arrive at an understanding of the significance of the Churinga. The information derived is briefly as follows.

Each ceremony was connected with some particular totem and, further, with some special locality, and each one dealt with some particular ancestral individual or individuals. The traditions of the tribe refer back to a long past time called the Alcheringa (which means dream-times), when their ancestors were designated by the name of, usually, some animal or plant. Thus we have a group of individuals living in the Alcheringa, of whom it is difficult to say whether they were men-kangaroos or kangaroo-men, the identity of the human individual being sunk in that of the object with which he is associated, whose name he bears, and from whom he sprung. These kangaroo-men walked about the country now inhabited by the tribe, following a definite route and halting at certain places, the positions of which are well known to the natives by means of the traditions which have been handed down from generation to generation. In a similar way groups of Emu, Frog, Mulga, Wild Cat, and other individuals walked across the country.

Each one of these Alcheringa ancestors carried with him or her a number of sacred Churinga, and where they halted, there an oknannikilla or local totem centre was formed. At each spot, so says tradition, certain individuals went into the ground, and each became a Churinga, which is associated with the spirit part of the individual. Not only this, but at each such spot they deposited a large number of the Churinga which they carried, and with each one of which in the same way a spirit individual was associated.

Then the whole area now occupied by the tribe became, as it were, dotted over with a large number of local totem centres, and this idea of spirit individuals of definite totems, associated with Churinga and resident in certain spots, lies at the root of the present totemic system of the Arunta and other tribes of Central Australia.

Thus we have close to Alice Springs a large and important Witchetty Grub totem centre, and the following will serve as a typical example of how each man and woman gain a totem name. There were deposited in the Alcheringa, close by Alice Springs, a large number of Witchetty Churinga, each of course associated with a spirit individual. The latter can move about, and always carries with it its Churinga, and is supposed to frequent some special tree or stone, which is called its *Nanja* tree or stone. When a woman conceives, it is one of these spirit individuals who has entered her body, and therefore, quite irrespective of what the father or mother's totem may be, the child when born must of necessity belong to the spot at which it was conceived, or rather at which the mother believes that it was. Recently, for example, an Emu woman from another locality came on a visit to Alice Springs. There she conceived a child, but returned to her own Emu locality before that child was born. When born, that child was a Witchetty Grub—it must be, the natives say, because it entered the mother's body at Alice Springs, which is a Witchetty totem centre ; it is, in fact, nothing more nor less than the reincarnation of an Alcheringa Witchetty Grub. Had it entered the mother within the limits of her own Emu locality, it would as inevitably have been born an Emu

Further, when the spirit-child enters the mother, it drops its Churinga. After it is born the mother tells the father exactly where it was conceived—that is, the spot where she first became aware that she had conceived a child—and the father and one or two other men go there, and either search until they find the Churinga, or if they do not find one, then they make one out of the mulga or other hard wood tree which lies nearest to the Nanja tree, carve on it the design of the child's totem, and hand it over for safe keeping to the head man of that locality, who places it in the sacred storehouse where all the Churinga of that totem centre are preserved. This Churinga becomes the Churinga Nanja of the child.

The meaning and importance of the Churinga may be gathered from the above sketch, from which many details, to be published later, are of necessity omitted.

It is during the Engwurra, and whilst the ceremonies concerned with the totems are being performed, that the old men of the tribe show the Churinga to the younger men, telling them to whom they have belonged and the traditions associated with them, and thus ensure the passing on of this knowledge from generation to generation ; in fact, in ceremonies such as these we see the earliest beginnings of historical records.

Whilst the Engwurra is largely concerned with the performance of the sacred ceremonies, an equally important part is played by the fire ordeals from which the name is derived, and to which reference must now be briefly made. A full description of these, together with illustrations from photographs taken by the authors, will be published as soon as possible.

During the last month of the time occupied by the performance of the Engwurra the young men, who are being made Urliara, are taken out into the bush every day before sunrise, under the charge of certain elder men. There they have to remain all day hunting game, which must be brought in to the elder men, who stay in camp performing ceremonies. The young men are not supposed to eat much, and become poorer and poorer as the weeks pass by. Usually, but not always, they are brought back to the Engwurra ground by way of the women's camp. Just before sunset the women—Bultharra and Panunga in one spot, and Purula and Kumarra in another, some little distance apart—make a fire of bushes, and, standing behind this, move their hands as if inviting the young men, who are now called Illpongwurra, to approach. This they do, holding shields and boughs of a particular shrub over their heads. Then the lubras or women, carrying burning grass and boughs, run towards them, and throw the burning material over their heads. The men have to protect themselves with shields as well as they can, and after going to each fire they turn tail, followed by the women, who stop and run back again when they reach the bed of the river, on the other side of which lies the Engwurra ground, which they must not approach. Arrived at the latter, the young men lie down in a long row, each man having his head upon the Parra. Perfect silence is maintained, and here they must remain until the old men give them permission to arise. Each old man takes charge of four or five young men, who become what is called *apmûrra* to him and he to them, and no young man may speak to, or in the presence of, his apmûrra till all is over.

Within the last week of the ceremony the young men have to undergo another and more severe ordeal. In a secluded spot amongst the hills the old men, who have gone out in charge of them, make a large fire of logs. When these have burned down, and the red-hot ashes remain, green boughs of Eucalyptus are thrown on the fire, and on these the young men have to lie down in the heat and stifling smoke until they receive permission from the old men to get up.

Finally, on the last night the men all congregate around a sacred pole which has been erected close by the Parra, and here, all night long, the old men decorate the backs and chests of the younger men with designs, often very elaborate and distinctive, of the various totems. A man is not of necessity—in fact, very seldom is—painted with the design of his own totem. All night long the women remain awake and active in their camp across the river, where again they make two fires in shallow pits, but this time closely side by side.

Before sunrise the decorated men gather together at the base of the sacred pole, the head man of the ceremony breaks through the Parra mound, and across the opening thus formed the old men lead their charges, all walking in single file and holding one another's hands. In perfect silence the string of painted men pass from the Engwurra ground across the bed of the creek, and so on to the women's camp, where they form a group, and halt some fifty yards away from the women, who stand behind their fires, which are now giving off dense clouds of smoke from green gum boughs.

Then each old man takes the younger ones under his charge, and with them runs up to the fires. The Bultharra and Panunga men go to the fire made by the Purula and Kumarra women, and *vice versâ*, kneeling upon it while the women press them down with their hands upon the men's shoulders. When all have been upon the fires, the old men and the newly-made Urliara cross the river-bed again to the Engwurra ground, and sit around the sacred pole. The fire ceremonies are now complete, but as yet the younger men may not speak to their apmūrra, but must remain out in the bush. After a length of time, varying from two weeks to perhaps six months, each young man brings in a present of food called Chowarilya to his apmūrra man, when a sacred ceremony is performed, at the close of which the mouths of the old and young men who are present are touched either with the food brought in, or with some object which has been used in the ceremony, and the ban of silence is removed.

PROFESSOR NEWCOMB ON THE DISTANCES OF THE STARS.[1]

THE problem of the distances of the stars is of peculiar interest in connection with the Copernican system. The greatest objection to this system, which must have been more clearly seen by astronomers themselves than by any others, was found in the absence of any apparent parallax of the stars. If the earth performed such an immeasurable circle around the sun as Copernicus maintained, then, as it passed from side to side of its orbit, the stars outside the solar system must appear to have a corresponding motion in the other direction, and thus to swing back and forth as the earth moved in one and the other direction. The fact that not the slightest swing of that sort could be seen was, from the time of Ptolemy, the basis on which the doctrine of the earth's immobility rested. The difficulty was simply ignored by Copernicus and his immediate successors.

An indication of the extent to which the difficulty thus arising was felt is seen in the title of a book published by Horrebow, the Danish astronomer, some two centuries ago. This industrious observer, one of the first who used an instrument resembling our meridian transit of the present day, determined to see if he could find the parallax of the stars by observing the intervals at which a pair of stars in opposite quarters of the heavens crossed his meridian at opposite seasons of the year. When, as he thought, he had won success, he published his observations and conclusions under the title of "Copernicus Triumphans." But, alas! the keen criticism of his contemporaries showed that what he supposed to be a swing of the stars from season to season arose from a minute variation in the rate of his clock, due to the different temperatures to which it was exposed during the day and the night. The measurement of the distance even of the nearest stars evaded astronomical research, until Bessel and Struve arose in the early part of the present century.

On some aspects of the problem of the extent of the universe light is being thrown even now. Evidence is gradually accumulating which points to the probability that the successive orders of smaller and smaller stars, which our continually increasing telescopic power brings into view, are not situated at greater and greater distances, but that we actually see the boundary of our universe. This indication lends a peculiar interest to various questions growing out of the motions of the stars. Quite possibly the problem of these motions will be the great one of the future astronomer. Even now it suggests thoughts and questions of the most far-reaching character.

I have seldom felt a more delicious sense of repose than when crossing the ocean during the summer months I sought a place where I could lie alone on the deck, look up at the constellations, with *Lyra* near the zenith, and, while listening to the clank of the engine, try to calculate the hundreds of millions of years which would be required by our ship to reach the star α Lyræ if she could continue her course in that direction without ever stopping. It is a striking example of how easily we may fail to realise our knowledge when I say that I have thought many a time how deliciously one might pass those hundred millions of years in a journey to the star α Lyræ, without its occurring to me that we are actually making that very journey at a speed compared with which the motion of a steamship is slow indeed. Through every year, every hour, every minute, of human history from the first appearance of man on the earth, from the era of the builders of the Pyramids, through the times of Cæsar and Hannibal, through the period of every event that history records, not merely our earth, but the sun and the whole solar system with it, have been speeding their way towards the star of which I speak on a journey of which we know neither the beginning nor the end. During every clock-beat through which humanity has existed it has moved on this journey by an amount which we cannot specify more exactly than to say that it is probably between five and nine miles per second. We are at this moment thousands of miles nearer to α Lyræ than we were a few minutes ago when I began this discourse, and through every future moment, for untold thousands of years to come, the earth and all there is on it will be nearer to α Lyræ, or nearer to the place where that star now is, by hundreds of miles for every minute of time come and gone. When shall we get there? Probably in less than a million years, perhaps in half a million. We cannot tell exactly, but get there we must if the laws of nature and the laws of motion continue as they are. To attain to the stars was the seemingly vain wish of the philosopher, but the whole human race is, in a certain sense, realising this wish as rapidly as a speed of six or eight miles a second can bring it about.

I have called attention to this motion because it may, in the not distant future, afford the means of approximating to a solution of the problem already mentioned, that of the extent of the universe. Notwithstanding the success of astronomers during the present century in measuring the parallax of a number of stars, the most recent investigations show that there are very few, perhaps hardly more than a score of stars of which the parallax, and therefore the distance, has been determined with any approach to certainty. Many parallaxes, determined by observers about the middle of the century, have had to disappear before the powerful tests applied by measures with the heliometer; others have been greatly reduced, and the distances of the stars increased in proportion. So far as measurement goes, we can only say of the distances of all the stars, except the few whose parallaxes have been determined, that they are immeasurable. The radius of the earth's orbit, a line more than ninety millions of miles in length, not only vanishes from sight before we reach the distance of the great mass of stars, but becomes such a mere point that, when magnified by the powerful instruments of modern times, the most delicate appliances fail to make it measurable. Here the solar motion comes to our help. This motion, by which, as I have said, we are carried unceasingly through space, is made evident by a motion of most of the stars in the opposite direction, just as, passing through a country on a railway, we see the houses on the right and on the left being left behind us. It is clear enough that the apparent motion will be more rapid the nearer the object. We may, therefore, form some idea of the distance of the stars when we know the amount of the motion. It is found

[1] Extracted from an address given by Prof. Simon Newcomb at the dedication of the Flower Observatory, University of Pennsylvania, May 12.

that, in the great mass of stars of the sixth magnitude, the smallest visible to the naked eye, the motion is about three seconds per century. As a measure thus stated does not convey an accurate conception of magnitude to one not practiced in the subject, I would say that, in the heavens, to the ordinary eye, a pair of stars will appear single unless they are separated by a distance of 150 or 200 seconds. Let us then imagine ourselves looking at a star of the sixth magnitude, which is at rest while we are carried past it with the motion of six or eight miles per second which I have described. Mark its position in the heavens as we see it to-day; then let its position again be marked 5000 years hence. A good eye will just be able to perceive that there are two stars marked instead of one. The two would be so close together that no distinct space between them could be perceived by unaided vision. It is due to the magnifying power of the telescope, enlarging such small apparent distances, that the motion has been determined in so small a period as the 150 years during which accurate observations of the stars have been made.

PRIMITIVE METHODS OF DRILLING.

"A STUDY of the Primitive Methods of Drilling" is the title of a monograph by Mr. J. D. McGuire, in the recently-published Report of the United States National Museum (1894). The paper covers 125 pages of the Report, and is fully illustrated, in addition to which there are numerous references to books of travel among peoples living under the most primitive conditions. The author of the paper verified his opinions during the progress of the work by experiments in a laboratory fitted up for the purpose in the United States National Museum.

The paper discusses the various ways by which holes are bored in material, ranging from the softest to the hardest known, with such implements as were possessed by different peoples throughout the age of stone, and well through that of metal. The implements employed in performing the work were chiefly such as are on deposit in the Museum, the collections of which, especially from the North American tribes of Indians, are very rich. Yet the author has not hesitated, where circumstances warranted, to seek further afield for examples, notably in the concluding portion of the paper, where he describes a heretofore unrecognised drill, which frequently appears on the bases of royal seats among Egyptian antiquities. The act of cutting a hole through stone, or other substance, is shown to be a much simpler process than archæologists have heretofore supposed. The author has shown by specimens, and by quotations, that man, from the first time of which we have evidence of his existence, perforated with apparent ease material, such as shell or bone or ivory, and that to do this required nothing more than a stick or a stone with a little sand.

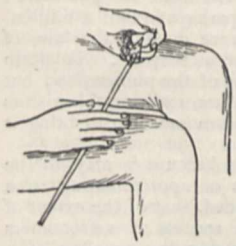


FIG. 1.—Horizontal drilling.

It is shown that early in the Lake period of Switzerland, a hollow cylinder of metal was often employed in boring stone axes, and the same conditions have existed from very early times in the history of the most ancient nations of which we have any records.

The seals of Mesopotamia, as well as the earliest intaglios, it is asserted, were bored with the drill and wheel from a period ante-dating the Christian era by thousands of years. The author shows that the American Indian, at the time of the discovery of the country, employed only the simple shaft-drill revolved between the extended palms of the hands, a method yet in use among the most primitive peoples in producing fire. The same implement, revolved horizontally upon the thigh, is illustrated in Fig. 1, by which means any of the simpler holes found in the earliest antiquities may be readily and quickly reproduced.

The "Bow Drill" (Fig. 2) is represented in the monograph as it has been employed by various races, ancient and modern, showing the manner of working it, and the differences in shape of the bow and shaft of the drill. The author calls attention to Fig. 3, which he says is the drill bow of ancient Egypt carried in sacred processions as an emblem of ceremony.

Fig. 4 is a drill of a complicated character used by certain California tribes, and appears to be an aboriginal American outgrowth of the "Pump Drill," which was imported into the country from Europe or Asia in modern times. The author illustrates what he designates as a "Top Drill" (Fig. 5), worked by means of a single strap and head-piece, which was developed in the course of his experiments. While in itself this drill is not claimed to be of any great value, it did lead to most interesting developments, the principle of which is, among other things, recognised in the Hindu statue of Samudra Mutu (the third incarnation of Vishnu). This again, in its turn, led to the recognition of the "Disc Drill" with double string, shown in Fig. 6, a most common glyph among early and late Egyptian antiquities known as the "S. S. M." or "Sam," which is by some authors thought to be "an altar typical of the Upper and Lower Nile joined under a single Pharaoh." Such a drill was set up in the Museum laboratory, and was found to work with perfect ease, and to be capable of producing any of the holes met with among the bored monumental stones of Egypt. The number of persons who, upon occasion, might be employed at the same time in working this drill, is unlimited; though probably not more than four would be required at any one time.

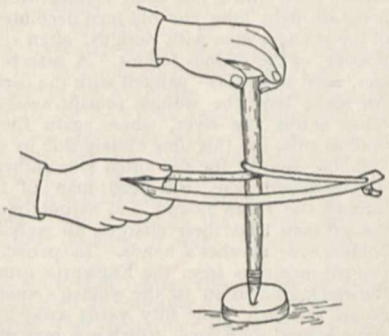


FIG. 2.—Single-handed Bow Drill in use.

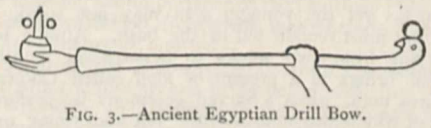


FIG. 3.—Ancient Egyptian Drill Bow.

The author not only tested the different stone points employed in boring stone and softer substances, but used the stone points themselves with sands of differing hardness upon different stones. Metal points to drills, as well as metal cylinders, were tested as to their cutting properties. Points of all kinds were experimented with, demonstrating that the sharp sand and wood points are capable of cutting a hole through any material, provided it was not harder than the sand. The paper shows the different characters of holes met with in objects of a prehistoric period, or by people in a low stage of mechanical development, and describes how such holes were made.

In most instances the exact number of revolutions per minute of each separate drill was recorded, and the character of cutting material was noted; the results were in every instance uniform. The velocity of revolution and hardness of the sand determined with mathematical accuracy the time required to drill a hole through any given material.

The striæ noticed upon the cores left in some holes bored in stone in Egypt had led distinguished Egyptologists to believe that the Egyptians possessed the diamond drill, with diamonds not only set in the lower edge of the cylinder, but on the outer and inner sides as well. Mr. McGuire's experiments have demonstrated that with such a drill as represented in Fig. 6, a hole of almost any diameter may be made through the hardest stone, and that the marks left on the interior of the drill-hole, or exterior of the core in the hole, is governed entirely by the hardness of the sand and size of its grains. The time requisite to perforate any material is shown to be but a fraction of what has been heretofore supposed necessary.

FIG. 4.—Disc Drill (California).

The paper proves the value of a study of the technology of archæology, and its necessity in any intelligent study of primitive implements. The manufacture of any product of ancient man

carries additional information to that which may be gathered merely from the shape of the article. Crushing stone, hammering or breaking it, by heat or cold, by pressure applied in any of the many known ways, each and every item of personal work has its value, and no one can say in advance to what its inspection may lead. We gather here, if the author be correct in his claims, data which no one could have anticipated in advance of experiments.

The long-stone drill points are found unsuited to boring substances which wood and dry sand will cut with ease. Soft wood is shown to be as unsuited as is hard wood for drill shafts. The hard stone point is found to cut steatite or wood quite

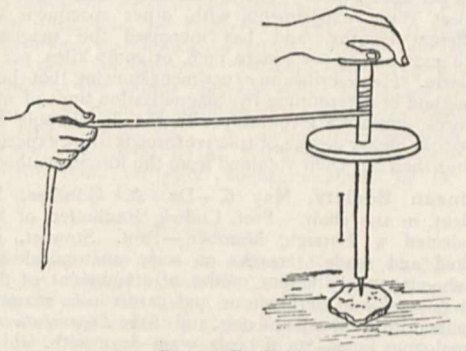


FIG 5.—Top Drill

readily, but is easily broken if it is attempted to bore hard stone with it. The study has been a careful one, has extended over a long period, and no known source of information has been intentionally neglected. Personal acquaintance with drills and their workings, as developed in the paper, is calculated to familiarise one with the Australian or American producing fire with the plain shaft-drill. It enables us to see in a new light Ulysses and his companions boring the eye from the Cyclops king. It gives a new interpretation to one of the incarnations of Vishnu. The remark of the latter, that their foes "should share their toil," suggests further, that instead of the "Nile gods" being

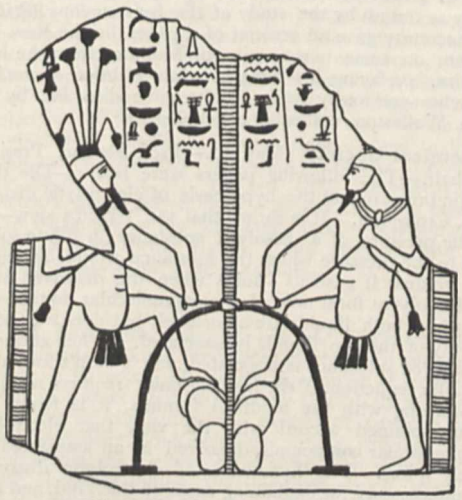


FIG. 6.—Disc Drill on Base of Statue of Amennemhat.

shown in Fig. 6, we see the citizens of a subjugated territory performing ordinary menial labour. The so-called "gods" themselves are usually females, Negro or Asiatic, who hold the straps of the drill. It will be interesting to inquire whether under the late Nubian dynasty the Negro disappears from the work, and the Egyptian takes the subordinate place when the latter became subject to the Negro dynasty. The drill represented in the closing pages of the paper is capable of performing more and better work in boring stone than any other known hand-implement, either of ancient or modern date. This drill familiarises us somewhat with the high degree of skill possessed by the Egyptian workman of a remote antiquity. The author, in reproducing the Egyptian drill, has no doubts as to the identity of its shaft, its disc, the straps used to revolve it, or of the principle upon which it worked. He also believes that it was braced in some way. The bracing and method of tightening down the braces, invariably accompanying the drill, and even the possibility of the shafts having been tautened by strings or straps, are matters not satisfactorily interpreted. It will be a matter of interest to have more examples of this implement, which acquaints us with the man of Ancient Egypt in possession of a very complicated machine at a period in the life of the nation centuries prior to any date heretofore suggested. The scarcity of works and photographs on Egypt accessible to the author, prevents the hope that he may further interpret with available material the braces and means of tightening down this drill; but it is suggested that, in Europe and the East, there may be found sufficient data to answer this enigma.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—Prof. W. J. Sollas, F.R.S., has been appointed a delegate to attend the International Geological Congress to be held at St. Petersburg in August or September next.

The following examiners for the Honour School of Natural Science have been appointed:—Physics: Mr. S. A. F. White. Chemistry: Mr. V. H. Veley, F.R.S. Physiology: Prof. F. Gotch, F.R.S. Morphology: Mr. G. C. Bourne, Mr. Adam Sedgwick, F.R.S. Botany: Mr. P. Groom, Mr. R. W. Phillips. Geology: Prof. W. J. Sollas, F.R.S., Dr. J. W. Gregory.

There are thirty-eight entries this year in Natural Science; eighteen of these are in physiology, twelve in chemistry, three in animal morphology and physics respectively, and two in geology.

The degree of Honorary M.A. has been conferred upon the Mayor of Oxford, Alderman Buckell, J.P. This is the first time that the University has conferred a degree on the Mayor of the city.

Miss Kingsley gave a public lecture at Manchester College on Friday last, on "The Connection of Fetish with West African Customary Law: a Study in Primitive Religion."

CAMBRIDGE.—The Rev. Prof. Wiltshire has presented to the Woodwardian Museum his valuable geological library, consisting of about 600 volumes and 900 pamphlets.

Prof. Macalister announces a course in Osteology, and Mr. J. E. Marr a course in Practical Geology, in the ensuing Long Vacation.

The Council of the Senate propose the re-establishment of the Professorship of Chinese, held by the late Sir Thomas F. Wade. It is understood that a distinguished Chinese scholar is willing to accept the office without stipend, and to undertake the charge of the magnificent collection of Chinese books given to the University by the late Professor. The collection is said to be unmatched in Europe, and probably in China.

The examination in Agricultural Science for the University's diploma will be held from July 5 to July 12.

The degree of LL.D. is to be conferred on Colonel Maharaj Dhiraj Sir Pratap Singh, K.C.S.I., as representing India, on June 17, when the Colonial Premiers are to receive honorary degrees.

A grant of 300*l.* from the Worts Fund has been made to Dr. A. C. Haddon, towards the expenses of an anthropological expedition to the Torres Straits. It is understood that Dr. Haddon will be accompanied by two or three other Cambridge men skilled in various branches of anthropological research, and by an expert in the Melanesian languages.

A grant of 100*l.* has also been made to Mr. H. H. W. Pearson for botanical research in Ceylon.

Dr. Humphry, Dr. Foxwell, Dr. Sidney Martin, and Dr. Mitchell Bruce have been appointed Examiners in Medicine; Dr. Phillips and Dr. Cullingworth, Examiners in Midwifery; and Mr. Pitts, Mr. Bennett, Mr. Watson-Cheyne, and Mr. Golding-Bird, Examiners in Surgery for the ensuing year.

THE London Technical Education Board has appointed Dr. J. O. W. Barratt to the scholarship in sanitary science. Dr. Barratt will commence his research work under the pathological superintendent at Claybury Asylum during the present summer.

THERE can be no doubt that some of the polytechnic institutions in London are moving towards a higher educational status than they occupied a few years ago. The courses of study are systematised, and they are supervised by teachers who have had laboratory experience; hence they educate the mind as well as train the hand. An announcement that, in the next session (1897-98) Principal Tomlinson, F.R.S., of the South-west London Polytechnic, will establish a class for training in research, affords an instance of the higher tendency of polytechnic instruction. This research training will form part of the curriculum of the second year day electrical engineering students of the institute, but will be open to a limited number of other students provided they can show a fair knowledge of the elementary principles of physics and mathematics. The method of conducting any research will be as follows:—The Principal will first select some subject for investigation suitable for electrical engineering students. He will then fully explain to the class the various reasons which have induced him to make the selection, and will give a brief history of what has been previously done round and about the subject, and full reference thereto. He will also propound a mode or modes of attacking the research, and invite criticisms from the class. When the best mode of attack has been decided on, the class will be expected not only to take part in the experiments, but to help in preparing the required apparatus. Should the results obtained be of sufficient importance, they will be offered in the form of a paper to such societies as the Royal Society, the Physical Society, or the Institution of Electrical Engineers. From time to time during the investigations the Principal will give demonstrations or lectures on those particular branches of magnetism and electricity which bear directly on the investigation, and will illustrate them by the results obtained. The subject selected for the first research is "the effect of repeated heating on the magnetic permeability and electrical conductivity of iron and steel."

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, May 13.—"On the Passage of Heat between Metal Surfaces and Liquids in contact with them." By T. E. Stanton, M.Sc. Received April 7.

An experimental investigation was undertaken to determine the rate of transmission of heat from the walls of a heated metal pipe to colder water flowing through it. By means of the apparatus constructed for this purpose the velocity, initial and final temperatures, and pressure of the water, also the surface temperature of the pipe, could be observed; and by varying the initial temperature and velocity of the water, the effect of varying ranges of temperature and velocity of water could be experimentally studied.

The results of the experiments showed that the heat transmitted from any small surface of the pipe

(1) was independent of the pressure of the water;
(2) was proportional to the range of temperature between the surface and the flowing water;
(3) was *approximately* proportional to the velocity of the water;
(4) was proportional to a function of the viscosity of the water; or, putting

H = heat transmitted, S = surface of pipe,
V = velocity of water, T_o = surface temperature of pipe,
t = temperature of water,

that $$\frac{dH}{dS} = k.(T_o - t)V^m(1 + \alpha T_o)(1 + \beta t)$$

where $m = .85$ $\alpha = .004$ $\beta = .01$.

It is also shown that these results are in accordance with Prof. Osborne Reynolds' theory of the convection of heat from a hot surface to water flowing over it, this theory being that the motion of heat in the pipe follows the same law as the motion of momentum, as far as convection and conduction are concerned; so that, from Prof. Reynolds' equation for the fall of pressure in a pipe, the value of the slope of temperature may be expressed, the constants in which may be determined by experiment.

In this theoretical expression for the slope of temperature it is seen that the effect of the velocity of the water is very small, which is the most remarkable fact brought out by the experimental research.

"On the Magnetisation Limit of Iron." By Henry Wilde, F.R.S. Received April 3.

In a former paper read before the Society, "On the Influence of Temperature on the Magnetisation of Iron," the author described a new method of determining the magnetisation limit of magnetic substances, by which, with a single pole of an electro-magnet, a more exalted degree of magnetisation was indicated, as measured by the force of traction, than had previously been attained (*Roy. Soc. Proc.*, 1891, vol. l.). The magnetisation limit of iron, as deduced from his experiments, was 381 pounds per square inch of section, and it appeared to him at the time that the extreme limit was well within 400 pounds per square inch. The author has recently had occasion to repeat these experiments with other specimens of iron of different lengths, and has increased the magnetisation limit to 422 pounds per square inch, or 29·67 kilos. per square centimetre. He describes an experiment showing that the single-pole method of determining the magnetisation limit of magnetic substances compares favourably with the double-pole method, and that no higher degree of tractive force is to be expected from the latter than has been obtained from the former method.

Linnean Society, May 6.—Dr. A. Günther, F.R.S., President, in the chair.—Prof. Ludwig Radlkofer, of Munich, was elected a Foreign Member.—Prof. Stewart, F.R.S., exhibited and made remarks on some anatomical preparations showing the different modes of attachment of the *Ligamentum nuchæ* in herbivorous and carnivorous mammals, as exemplified in the sheep and dog, and of the *Ligamenta subflava*. The analogous ligaments of birds were dealt with, and special attention was drawn to a preparation of the vertebral column of the python, showing *vertebra-costal fibro-cartilaginous plates* of which he could find no description and which he believed to be peculiar to the Ophidia.—The Secretary read the abstract of a paper by Messrs. W. and G. S. West, on Desmids from Singapore. These had been discovered in a small collection of Algæ forwarded by Mr. H. N. Ridley from Singapore, and, in addition to seven species previously known from Sumatra, contained several which were new, and now described and figured.—Prof. Newton, F.R.S., communicated a paper by Captain F. W. Hutton, Curator of the Canterbury Museum, Christchurch, N.Z., entitled "The Problem of Utility," in which the views of Dr. A. R. Wallace on "The Utility of Specific Characters" (*Journ. Linn. Soc. Zool.*, xxv. pp. 481-496) were criticised, chiefly as tested by the study of the fruit-pigeons (*Ptilopus*).—The Secretary gave an account of a paper by the Rev. R. Bogg Watson, on some new species of Mollusca from the Island of Madeira, prefacing his remarks with a brief *résumé* of the researches previously made in the same direction by Messrs. Lowe, Wollaston, and other conchologists.

Chemical Society, May 20.—Prof. Dewar, President, in the chair.—The following papers were read:—The theory of osmotic pressure and the hypothesis of electrolytic dissociation, by H. Crompton. It is shown that van 't Hoff's view—that the osmotic pressure of a dissolved substance in dilute solution is equal to the pressure which the substance would exercise in the same volume if gaseous—holds when the dissolved substance and the solvent form normal or monomolecular liquids, and may hold when both liquids are associated, but does not hold when one only of the two liquids is associated. When either solvent or dissolved substance is associated, van 't Hoff's formula for the molecular reduction of the freezing point requires modification; on working with the modified formula, it is found that the results obtained accord with the view that electrolytes are monomolecular compounds dissolved in an associated solvent, namely water. The hypothesis of electrolytic dissociation is thus unnecessary for explaining cases of this kind, and is further inconsistent with what is known of the molecular character of liquids. The cube of the association factor of a liquid is approximately proportional to its specific inductive capacity.—Molecular rotations of optically active salts, by H. Crompton. The fact that optically active salts of strong acids have the same equivalent rotations in dilute solution is generally quoted in support of the dissociation hypothesis; the author shows, however, that similar regularities are observed in the case of other salts which are certainly not electrolytically dissociated, so that it would seem that monomolecular salts containing a common optically active radicle have the same equivalent rotation.—Heats of neutralisation of acids and bases in dilute aqueous solution, by H. Crompton. The author explains the constancy

of the heat of neutralisation of an acid by a base with the aid of the views developed in the preceding papers, and thus again shows that the electrolytic dissociation hypothesis is unnecessary. —A comparative crystallographical study of the normal selenates of potassium, rubidium and cæsium, by A. E. Tutton. The author is enabled, from the results of a very complete crystallographic examination of the selenates of potassium, rubidium and cæsium, to extend his previous conclusions deduced from a study of the sulphates and double sulphates of these three alkali metals; he shows that the characters of the crystals of isomorphous series are functions of the atomic weight of the interchangeable elements, belonging to the same family group, which give rise to the series.—The platinum-silver alloys; their solubility in nitric acid, by J. Spiller. The usual statement that, on dissolving platinum-silver alloys in nitric acid, from 5 to 9 per cent. of platinum dissolves with the silver, seems erroneous; the author only succeeded in causing about 1 per cent. of platinum to accompany the silver into solution. —Dalton's law in solutions. The molecular depression of mixtures of non-electrolytes, by M. Wilderman.—The action of bromdiphenylmethane on ethyl sodacetoacetate, by G. G. Henderson and M. A. Parker.

EDINBURGH.

Royal Society, May 17.—Sir Arthur Mitchell, K.C.B., in the chair.—An obituary notice of the late Dr. E. Sang was read by J. Bruce Peebles, Esq., in which he emphasised the desirability of the purchase by Government, or some learned Society, of Dr. Sang's invaluable logarithmic tables.—Dschâbir Ben Hayyán, and the chemical writings ascribed to him. Part ii., by Prof. John Ferguson.—A communication was read by Percy H. Grimshaw, on some type specimens of Lepidoptera and Coleoptera in the Edinburgh Museum of Science and Art. The paper dealt with 52 species of butterflies and 19 of beetles, the type specimens of which had been discovered by the author in a collection purchased by Edinburgh University from M. Dufresne, of Paris, in 1819, and afterwards transferred to the museum. The most important results embodied in the paper are as follows. One of the beetles has been found to be the type of a new genus, the specimen in question being probably unique; it has been found necessary to re-name one species of butterfly and one beetle; errors have been corrected in synonymy, &c., in the case of 19 species; and 8 species hitherto wrongly placed have been referred to their proper genera. The type specimens, together with coloured drawings, by Mr. Grimshaw, of the more important, were exhibited at the meeting. The same author read a short account of a melanic specimen of *Hestina nama*, Doubleday, which had been found in a small collection of butterflies purchased by the museum in 1890. The specimen described is very close indeed to the aberration named by Oberthür *melanina* ("Études d'Entomologie," xx. 1896, p. 30, tab. 10, No. 177), but differs in several particulars, being generally of a darker tint, the inner series of white markings on the fore wing, and the ferruginous border of the hind wing being absent. The specimen and a coloured drawing of the same were exhibited.

PARIS.

Academy of Sciences, May 31.—M. A. Chatin in the chair.—New studies concerning the history of the lunar surface, by MM. Lœwy and Puiseux.—On the disaggregation of comets. Effect of Jupiter upon short-period comets, by M. O. Callandreau. Regarding a comet as consisting of a swarm of particles of spherical form, the density either being constant or varying only with the distance from the centre of the swarm, an expression is theoretically deduced giving the relations which should exist between the distance from the sun, the velocity, the ratio of the product of the masses of the sun and comet to the attraction constant, and the limiting radius of the orbit of an external particle. Under certain conditions the combined effect upon the disaggregation of the comet of the sun and Jupiter, near aphelion, may exceed that of the sun near perihelion.—Gradual flow of liquids in channels of large section. Fundamental equations, by M. J. Boussinesq.—On the liquefaction of fluorine, by MM. H. Moissan and J. Dewar (see p. 126).—On the function of humic materials in the fertility of soils, by M. Armand Gautier.—Physiological researches on the *sphincter ani* muscle, peculiarity shown by its reflex innervation and contraction, by MM. S. Arloing and Edouard Chantre.—M. Bouquet de la Grye announced to the Academy the loss it had sustained by the death of M. Léopold Manen, Correspondant for the Section of Geography and Navigation.—Report on the precautions necessary in the installation of electric conductors in the neighbourhood of powder magazines. The Committee report that no distinction can be drawn between telephone or telegraph wires and electric light mains. A distance of 10 metres would appear to be sufficient to avoid all risk with underground wires. The same distance is necessary in the case of water and gas pipes, as under certain conditions of leakage from neighbouring conductors they may become dangerous. For overhead lines a much greater distance is advisable, at least 20 metres.—Action of zinc and other metals upon the photographic plate, by M. R. Colson.—On partial differential equations of the second order the two systems of characteristics of which are confused, by M. E. von Weber.—On systems of complex numbers, by M. E. Cartan.—On the convergence of uniform substitutions, by M. E. M. Lémeray.—On the small periodic movements of systems, by M. P. Painlevé.—On the efficiency of gears, by M. L. Lecornu.—On a means of recognising a good cryoscopic method, by M. Ponsot.—On the purification of cerium, by MM. Wyrouboff and A. Verneuil. The oxides arising from the ignition of the oxalates are dissolved in nitric acid, and ammonium nitrate added in certain proportions to the warm solution. The whole of the cerium existing as Ce_3O_4 is precipitated as a basic nitrate which contains neither didymium, lanthanum, nor yttrium earths.—Remarks by M. Moissan on the preceding paper. By fractionally dissolving impure cerium carbide in dilute acids, the solution obtained furnished on simple calcination a perfectly white oxide of cerium. — On the alloys of the silver-copper group, by M. F. Osmond.—The phosphorescence of strontium sulphide, by M. José Rodriguez Mourels.—Contribution to the study of the preparation of ordinary ether, by M. L. Prunier. The presence of sulphur dioxide among the usual products of the crude ether distillate, is accounted for by the formation of ethyl isethionate, $CH_2.OH.CH_2.SO_2.OC_2H_5$, which splits up at 140° into SO_2 and alcohol.—On some combinations of phenylhydrazine with metallic chlorides, by MM. J. Ville and J. Moitessier.—Apparatus for the commercial analysis of gases, by M. Léo Vignon. The apparatus is of the Orsatt type; but calculations are given, taking into account the effects of the dead space, so considerable in this class of instrument.—On the products of decomposition of calcium carbide, and on its employment as a phylloxericide, by M. E. Chuard. After the acetylene has been produced by the action of water, ammonia continues to be slowly given off. By preparing a carbide rich in phosphide, a phosphocarbide is produced possessing exceptionally powerful insecticidal properties.—New order of Insectivora of the middle Miocene at Grive-Saint-Alban (Isère), by M. Claude Gaillard.—A self-recording balance, by M. G. Weiss. Designed more especially for physiological purposes. —Remarks on the preceding paper, by M. Bouchard.—On the umbilical vesicule of the Cheiroptera, by M. Mathias Duval.—Medical statistics of the army of occupation at Cochin China, by M. Bonnafy.—On cases of radiographic erythema of the hands, by MM. Paul Richer and Albert Londe.—On the application of photography to the registration of effluvia given off by living beings in both normal and pathological states, by MM. Luys and David.—On aurora borealis, by M. E. M. Pozzi.—On a general equation of fluids, by M. G. Perry.

NEW SOUTH WALES.

Linnean Society, March 31.—The President, Mr. Henry Deane, in the chair.—The President delivered the annual address. The special subject of the address was an expansion of matters treated of in that of the previous year, namely, a consideration of the relations of the fauna and flora of Australia to those of other parts of the Southern Hemisphere. The affinities of the floras of the Cape of Good Hope and of West Australia; of South-eastern Australia and New Zealand, and of South America; and the discovery of fossil marsupials of an Australoid type in La Plata and Patagonia were passed in review; and the important bearing of evidence of this kind on the question of former possible land-connections between these countries where now deep seas are believed to exist, was discussed. Other cognate subjects touched upon were the moot subject of the permanence of ocean basins and continental areas; the present state of knowledge of the rigidity of the earth; and the causes of extreme changes of climate in past geological ages. The address concluded with some references to the earliest known dicotyledonous plants in

Australia and Europe.—Prof. J. T. Wilson was elected President for the current year.

Monthly Meeting.—Prof. Wilson, President, in the chair.—Descriptions of new Australian Lepidoptera, with notes on synonymy, by Oswald B. Lower. Twenty-six species referable to the sections Bombycina, Geometrina, Noctuina, Pyralidina and Tineina, were described as new.—Studies in Australian entomology, No. 8. Descriptions of two new Tiger-beetles, by T. G. Sloane. A new species of *Megacephala* from West Australia and of *Tetracha* from Barrow Creek, Northern Territory of South Australia, were described.—Notes on Australian fungi, by D. McAlpine. Ten species were added to the cryptogamic flora of New South Wales, of which six were described as new, and four were recorded for the first time, one of them in association with a new host.

DIARY OF SOCIETIES.

THURSDAY, JUNE 10.

MATHEMATICAL SOCIETY, at 8.—Models of the Regular Convex and Star Solids: W. W. Taylor.—The Calculus of Equivalent Statements (Sixth Paper): H. MacColl.—On the Primitive Substitution Groups of Degree Fifteen: Dr. G. A. Miller.—A Generalised Form of the Binomial Theorem: Rev. F. H. Jackson.

FRIDAY, JUNE 11.

ROYAL INSTITUTION, at 9.—Diamonds: W. Crookes, F.R.S.

ROYAL ASTRONOMICAL SOCIETY, at 8.—Theory of the Motion of the Moon; Note on the Mean Motions of the Lunar Perigee and Node: Prof. E. W. Brown.—Elements of Comet Perrine (*f*) 1896 November 2: C. J. Merfield.—Nebula H I. 43 Virginis: Prof. K. D. Naegamvala.—The Shower of Leonids in 1897: W. F. Denning.—Results of Double Star Measures with the 8-inch Equatorial at Windsor, New South Wales, in 1896: John Tebbutt.—*Probable* Papers: Notes on the Reduction of Stellar Photographs: A. A. Rambaut.—Photographic Observation of Comet *b*, 1896: A. A. Rambaut.

PHYSICAL SOCIETY, at 5.—The Effect of Sea-water on Induction Telegraphy: C. S. Whitehead.—A New Definition of Focal Length, and an Instrument for its Determination: Thomas H. Blakesley.—On the Decomposition of Silver Salts under Pressure: Dr. J. E. Myers and Dr. F. Braun.—On a New Way of determining Hysteresis in Straight Strips: Dr. Fleming, F.R.S.

MALACOLOGICAL SOCIETY, at 8.

SATURDAY, JUNE 12.

ROYAL BOTANIC SOCIETY, at 4.

LONDON GEOLOGICAL FIELD CLASS.—Excursion—Coulsdon to Merstham. Lower Chalk. Leave Cannon Street, 2.17; arrive Coulsdon, 2.59.

MONDAY, JUNE 14.

SOCIETY OF CHEMICAL INDUSTRY, at 8.—Note on a Possible Danger from Fire involved in the Transport of Barium Peroxide in Wooden Barrels: Dr. A. Dupré, F.R.S.—The Valuation of Commercial Nitrate of Soda: Dr. Pauli.—Recent Improvements in Smokeless Compounds and in Processes of Manufacture: Hudson Maxim.—Comparative Experiments on the Estimation of Phosphoric Acid: Alexander Cameron.—The Strength of Commercial Formaldehyde Solutions: W. A. Davis.

TUESDAY, JUNE 15.

ZOOLOGICAL SOCIETY, at 8.30.—On the Mammals obtained by Mr. John Whitehead during his Recent Expedition to the Philippines. With Field-Notes by the Collector: Oldfield Thomas.—On the Presence of Ribs in *Polyodon* (*Spatularia*) *folium*: Prof. T. W. Bridge.—On the Spiders of the Family *Theraphosidæ* (*Mygalidæ*) from the Ethiopian Region, contained in the Collection of the British Museum: R. I. Pocock.

ROYAL PHOTOGRAPHIC SOCIETY, at 8.

WEDNESDAY, JUNE 16.

ROYAL METEOROLOGICAL SOCIETY (Burlington House), at 4.30.—The Non-Instrumental Meteorology of London, 1713-1896: R. C. Mossman.—Hailstorm in the South-West of London, April 27, 1897: Charles Harding.

ROYAL MICROSCOPICAL SOCIETY, at 7.30.—Exhibition of Palates of Mollusca from a Collection recently presented by Mr. C. Rousselet.

THURSDAY, JUNE 17.

ROYAL SOCIETY, at 4.30.

LINNEAN SOCIETY, at 8.—On the Distribution of *Primula elatior*, Jacq.: Miller Christy.—On the Acari collected by Mr. H. Fisher, Naturalist of the Jackson-Harmsworth Polar Expedition, at Cape Flora, Northbrook Island, Franz-Josef Archipelago, in 1896: A. D. Michael.—Further Observations on Stipules: Sir John Lubbock, Bart., F.R.S.—On Minor Tension Lines between Plant Formations: Prof. Conway Macmillan.

CHEMICAL SOCIETY, at 8.—Ballot for the Election of Fellows.—The Reduction of Perthiocyanic Acid: F. D. Chattaway and H. P. Stevens.—Molecular Refraction of Dissolved Salts and Acids, Part II.: Dr. J. H. Gladstone, F.R.S., and W. Hibbert.—On a Space Formula for Benzene: Prof. J. Norman Collie, F.R.S.—On the Production of some Nitro- and Amido-oxypicolines: Dr. A. Lapworth and Prof. J. Norman Collie, F.R.S.—The so-called Hydrates of Iso-propyl Alcohol; Dr. T. E. Thorpe, F.R.S.—The Carbohydrates of the Cereal Straws: C. F. Cross, E. J. Bevan, and C. Smith.—Further Experiments on the Absorption of Moisture by Deliquescent Substances: H. Wilson Hake.

MINERALOGICAL SOCIETY, at 8.—On Blödite from the Punjáb: F. R. Mallet.—On Monazite and Xenolime in European Rocks: Orville A. Derby.—On the Identity of Sundtite and Webnerite: G. T. Prior and L. J. Spencer.

FRIDAY, JUNE 18.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—Sub-Oceanic Changes: Prof. John Milne, F.R.S.

SATURDAY, JUNE 19.

GEOLOGISTS' ASSOCIATION—Excursion to Leighton Buzzard. Director: A. C. G. Cameron. Leave Euston, 9.10 a.m.; arrive Leighton, 10.47 a.m.

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

BOOKS.—The Naturalist in Australia: W. Saville-Kent (Chapman).—Scientific Romances: C. H. Hinton, second series (Sonnenschein).—Waste and Repair in Modern Life: Dr. Robson Roose (Murray).—W. and A. K. Johnston's Geological Map of the British Isles, revised edition (Johnston).—Mineralogical Geology. A Synopsis for the use of Students, to accompany ditto: A. Johnstone (Johnston).—Smithsonian Institution. Annual Report to July 1895 (Washington).—U.S. Department of Agriculture. Weather Bureau. Report of the Chief of the Weather Bureau, 1895-96 (Washington).

PAMPHLETS.—Adriades: P. Pasinii (Venitûs, Visentini).—The Monetary Situation in 1897: G. M. Boissevain (Macmillan).

SERIALS.—Strand Magazine, June (Newnes).—Middlesex Hospital Journal, No. 3 (London).—Journal of the Anthropological Institute, May (K. Paul).—Catalogus Mammalium, nova editio, Fasc. 2 (Berolini, Friedländer).—Bulletin de l'Académie Royale des Sciences, &c., de Belgique, 1897, No. 4 (Bruxelles).—Memoirs and Proceedings of the Manchester Literary and Philosophical Society, Vol. 41, Part 3 (Manchester).—Observatory, June (Taylor).—Himmel und Erde, May (Berlin, Paetel).—Atlantic Monthly, June (Gay).—Annals of the Astronomical Observatory of Harvard College, Vol. xxviii. Part 1 (Cambridge, Mass., Wilson).—Ditto, Vol. xxxvi. (Waterville, Me.).—Fortnightly Review, June (Chapman).

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