THURSDAY, NOVEMBER 23, 1882

THE CHALLENGER REPORTS

Reports on the Scientific Results of the Voyage of H.M.S. "Challenger" during the years 1873-1876, *under the Command of Capt. Sir George Nares, R.N., F.R.S., and Capt. F. T. Thomson, R.N.* Prepared under the Superintendence of Sir C. Wyville Thomson, F.R.S., and John Murray. Zoology—Vols. II., III., and IV. (Published by Order of Her Majesty's Government, 1881-1882.)

SINCE our last notice of these Reports, three more volumes of the zoological series have made their appearance. In vol. ii. published in 1881, and prepared under the superintendence of the late Sir C. Wyville Thomson, the first Report is by Prof. Moseley: On Certain Hydroid, Alcyonarian and Madreporian Corals procured during the Voyage. The great interest and importance of Mr. Moseley's investigations into the structure of the Hydrocorallinæ, and on the Helioporidæ and their allies, justified a previous publication, chiefly in the *Philosophical Transactions*, of the chief results of the author's work. The third part, describing the Deep Sea Madreporaria appears now for the first time. It ought to be noted that the memoirs forming the first two parts have been recast, and contain both additions and alterations. Mr. Moseley's history of *Millepora nodosa* will be acknowledged by all capable of judging, as a most solid contribution to our knowledge of the Hydrocorallinæ. So long ago as 1859, Agassiz announced that the structure of the polyps of Millepora showed that they belonged not to the corals, but to the Hydroids; but although this view was confirmed by others, especially by Pourtales, who once got an imperfect view of the expanded dactylozooids, still it remained for Prof. Moseley to settle this question of affinity beyond a doubt, which he has done by his painstaking dissections. He acknowledges his indebtedness to his colleague, Mr. Murray, who saw the zooids of *Millepora nodosa* in a living and expanded state upon the reefs of Tahiti. This species forms tubercular and irregular masses, often encrusting and overgrowing the dead fronds of *Lophoseris cactus*, which is a principal component of the Tahitian reefs. While fresh, the growing tips of the lobes have a bright gamboge yellow colour, fading off into a yellowish brown; the expanded zooids have the appearance of a close-set pearly white down upon the surface of the mass. Sometimes the encrusting film is very thin. When, as at Bermuda, *M. alcicornis* is found attached to glass bottles thrown into the harbour, this film will not be more than from $\frac{1}{8}$th to $\frac{1}{4}$th of a millimetre in thickness, and no doubt, now that attention is called to such specimens, they will be studied with the object of telling us more of the life history of these forms.

The Stylasteridæ, now definitely determined to be Hydroids, as was first strongly suggested by G. O. Sars, are described in great detail, and this portion of the report is accompanied by many splendid plates, and a list of all the species of Stylasteridæ at present known is given. Mosely places the group as a separate family, along side of the Milleporidæ, in the sub-order Hydrocorallinæ.

The second part of the report is on Helioporidæ and their allies, in which *Heliopora coerulea* is described from living specimens, and a detailed account of its structure and mode of growth is given. We have also an extremely valuable description of a species of Sarcophyton, almost certainly *S. lobatum*, from the Admiralty Islands, and the conclusion now so well known is come to that Heliopora is without doubt an Alcyonarian.

The third part comes as a quite fresh work, for the preliminary catalogue of the deep-sea Madrepores, was necessarily most imperfect. But here we have extended descriptions of the entire series of species dredged during the voyage, with sixteen plates and also numerous woodcuts intercalated throughout the text. No less than thirty-three species are described for the first time.

These deep-sea Madrepores would appear to be very widely distributed, some, as for example, *Bathyactis symmetrica*, having a world-wide range. At present the only genera which seem restricted in range are Stephanophyltia and Sphenotrochus, which have as yet only been obtained from the seas of the Malay Archipelago, and in comparatively shallower water, and the genus Leptopenus, which has been dredged throughout all the great oceans, but only south of the equator. The wide range of the species in depth has now become a well-known fact, though none the less interesting for that, the world distributed species above-mentioned ranging in depth from 70 to 2900 fathoms. The occurrence of the genera as fossils in Secondary and Tertiary deposits is also not without interest, but the deep-sea forms are not to be regarded as of greater geological antiquity than those found in shallow water.

The report on the birds collected during the voyage is by Dr. P. L. Sclater. The collection embraced about 900 specimens in skins, besides which there was a considerable series of sea-birds in salt and spirits, and a collection of eggs. The collection was formed under the superintendence of Mr. John Murray, who placed at Dr. Sclater's disposal his ornithological note-book, which contained the history of every individual specimen. It will be remembered that the main object of the expedition was the exploration of the depths of the ocean, and that the collecting of land birds formed no part of the original plan, so that the comparative smallness of the collection is not surprising. The author of the report expresses his indebtedness to his friends, the late Marquis of Tweeddale, Dr. Otto Finsch, Prof. Salvadori, Mr. Howard Saunders, Mr. W. A. Forbes, and Mr. Osbert Salvin, for the assistance they gave him in preparing this report, which is accompanied by thirty coloured plates. Many of the notes appended to the description of the penguins are taken from Mr. Moseley's published accounts of the voyage, and are doubtless already well known to our readers.

Vol. iii., published towards the close of 1881, opens with a most elaborated and magnificently illustrated report by Prof. Alexander Agassiz, on the Echinoidea. The importance of this report has already been called attention to in a special notice (*vide* NATURE, vol. xxv. p. 41).

The second and concluding report in the volume is on the Pycnogonida, by Dr. P. P. C. Hoeck. The collection of these forms was very rich in species. Of the 120 specimens dredged during the voyage, there were no less

than 36 species, and of these 33 are described as new to science. Five other species found during the cruise of the *Knight Errant* are also included in the report. These species are referred to 9 genera, of which three are described as new. Those genera which range over the widest area, are also those which range most in depth—while there are some species peculiar to deep-sea areas. No truly generic types seem to be thus characterised. Dr. Hoeck considers that the Pycnogonidæ form a distinct and very natural group or class of Arthropods. Their common progenitor must have been a form with three jointed mandibles—multi-jointed palpi and ovigerous legs, with numerous rows of denticulate spines on the last joints. In the most primitive condition the eye of the Pycnogonid consists of a rounded transparent part of the integument, the inner surface of which is furnished with some small ganglia and nerve-fibres issuing from the integumentary nerve-bundle. The highly-developed eye of the shallow-water species show ganglionic cells, distinct retinal rods, and a lens consisting of a thickened part of the chitinous skin of the animal. Those eyes which have lost their pigment and their retinal rods are rudimentary. Dr. Hoeck, treating of the affinities of this class writes: "about the relation in which the Pycnogonida stand to either the Crustacea or the Arachnida, we know as much or as little as we do about the relation in which these two classes of Arthropoda stand to each other."

Vol. iv. opens with an important contribution to anatomical science in the Report on the Anatomy of the Petrels (Tubinares) collected during the voyage. It is from the pen of Mr. W. A. Forbes, Fellow of St. John's, Cambridge.

The group of Petrels is one that up to the present date can scarcely be said to have been anatomically investigated. It is difficult at all times to procure specimens in the flesh—and some of the species are so large as to render their preservation a matter of considerable trouble. At the suggestion of the late A. H. Garrod, the naturalist staff of the *Challenger* made a fine collection of these oceanic birds in spirits, which contained 74 specimens belonging to 31 species and 22 genera. Prof. Garrod had scarcely commenced to work at this series before he was struck by the lingering illness which ended in his lamented and premature death, and his friend, Mr. W. A. Forbes, undertook to draw up the report which here appears. This report is of a very thorough character. Commencing with an account of the previous literature on the anatomy and classification of the group; we then have a complete sketch of the comparative anatomy of the group—the external characters, pterylosis and visceral anatomy are first described—these are succeeded by an account of the myology—to which follows a description of the tracheal structures and of certain other points in the anatomy of the soft parts, while an account of the osteology concludes the report. Some of the modifications, described by the author, "are of great physiological and morphological interest, whilst the numerous differences in points of detail displayed in the different sections and genera of the Petrels, lead one to expect that the future study of systematic ornithology will be not a little elucidated by the labours of the anatomist wherever he has material, as in the present case, at his command, sufficient for an adequate study of a natural group on the basis of structural differences more important than those that can be discerned from the superficial inspection of an ordinary skin." This report is illustrated by very numerous woodcuts and seven plates of anatomical details. In treating of the affinities of the group, Mr. Forbes declares it to be a difficult task to assign to it any satisfactory position in any arrangement of the class of birds.

The second report in the volume is on the Deep-sea Medusæ, by Prof. Ernst Haeckel. They form one of the smallest and least important groups of the rich and remarkable deep-sea fauna discovered during the voyage of the *Challenger*. The number of species described does not exceed eighteen, of which half are *Craspedotæ* and half *Acraspedæ*. These new species were briefly diagnosed in the "System der Medusen, 1879," but they are here described at great length and with a most splendid series of illustrations. The descriptive portion of the memoir is prefaced by a very elaborate sketch of the comparative morphology of the medusæ, which is illustrated by many woodcuts.

It would seem by no means certain that all the eighteen species of deep-sea medusæ here described are constant inhabitants of the deep sea. The method of capture by the tow-net by which such delicate and fragile organisms are brought from great depths is still imperfect, and it seems probable that the greater number of medusæ brought up apparently from the greater depths really swim in shallower water, and are only taken in during the "hauling-in" of the net. But Prof. Haeckel counts that those medusæ which have either adapted themselves by special modifications of organisation to a deep-sea habit of life, or which give evidence by their primitive structure of a remote phylogenetic origin, may with great probability be regarded as permanent and characteristic inhabitants of the depths of the sea; and as such he regards fourteen out of the eighteen described. With regard to the magnificent illustrations the author states: "It is of course impossible, from the imperfect state of preservation of the spirit specimens, to expect that they should be absolutely true to nature. I rather considered it my duty here, as in those figures in my 'System der Medusen,' which were drawn from spirit specimens, to take advantage of my knowledge of the forms of the living Medusæ to reconstruct the most probable approximate image of the living forms, I was greatly assisted in my efforts in this direction by the skilful hand of my lithographer, Adolf Giltsch." It seems hardly necessary to make any scientific criticisms on this straightforward statement.

The third and concluding memoir is by Hjalmar Théel, and contains the first part of his report on the Holothuroidea. It is altogether devoted to the holothuroids of the new order Elasipoda, which name has been with advantage substituted for that of Elasmopoda used in the Preliminary Report. Seven years have scarcely elapsed since the discovery in the Kara Sea of the form for which this family was established, and now over fifty species are known. These species of Elasipods are true deep water forms, and they may with all the more reason be said to characterise the abyssal fauna, as no single representative as far as is at present known has been found to exist at a depth less than 58 fathoms. Only one form,

Elpidia glacialis, has been dredged at this inconsiderable depth, and even this was dredged in the Arctic Ocean, where true abyssal forms are to be met with at comparatively shallow depths. This species too can exist at immense depths, one from Station 160 having been dredged at a depth of 2600 fathoms, the greatest depth at which any Holothuroid has to this been dredged being 2900 fathoms. Among the more remarkable and distinguishing characteristics of this order Mr. Théel mentions the agreement in several important details—both in their internal anatomy and outer forms—of the adult and larval forms, an agreement more close than occurs in any previously known Holothuroid. He does not agree with Danielssen and Korren in placing the Elasipods low in the series of the Holothuroids ; nay in some respects he regards them as having attained to a higher development than all the other Echinoderms, because, among other facts, their bodies are distinctly bilaterally symmetrical, with the dorsal and ventral surfaces distinct and often with a cephalic region well marked. Only the ventral ambulacræ are subservient to locomotion; these latter show a tendency to appear both definite as to place and number. The dorsal appendages are so modified as to perform functions different from the ventral ones. This memoir contains forty-six plates, which give full details of the forms and structure of all the new species.

LIGHT

Light: A Course of Experimental Optics chiefly with the Lantern. By Lewis Wright. (London : Macmillan and Co., 1882.)

THIS is a book by a worker whose work in his own line is of a very high order, and whose experience will be of correspondingly high value to others who are working at the same subject. In all those departments of experimental optics in which the lantern is employed for the demonstration of actual experiments to an audience, Mr. Wright is a master hand : and his book, as might be expected, is consequently a valuable repertory of useful information and of suggestive hints. Of books on Light there are already enough and to spare. Of standard treatises and text-books in the department of Geometrical Optics the supply is more than could be desired. In Physical Optics there is still room for a good elementary mathematical text-book. In Physiological Optics also there is, save for the great treatise of Helmholtz, a void. But the work before us stands apart from all these, both in aim and in character. Indeed so well does it carry out the ideal of a work "on experimental optics chiefly with the lantern," that there was really no need to prefix to the title the word "Light." True it is that Mr. Wright does not confine himself to the mere working of lanterns and their accessories. He deals in a simple and practical way with the laws of reflexion and refraction, and with ordinary optical instruments : but he always adds something of practical interest to the teacher of optics. To illustrate the laws of reflexion and refraction he describes a simplified form of the apparatus so well known in Prof. Tyndall's lectures on Light; and the mechanical illustrations of wave-motion, &c., are also new in several respects. The chapter on Spectrum Analysis is brief and sketchy, but includes almost all the experiments which can be projected on to the screen with the lantern. Amongst these we notice very careful instructions for exhibiting the spectrum of Newton's rings and of other interference phenomena.

Nearly one-half of the book is devoted, and well devoted, to experimental work on Double-Refraction and Polarisation. In this section there are a number of beautiful experiments described which we do not remember having seen before in any treatise in the English language. Amongst these are some with compound mica plates built up of a series of films of definite thickness and united by Canada balsam. A series of twenty-four superposed mica films, each producing a retardation of one-eighth of a wave-length and each one-sixteenth of an inch shorter than the one beneath it, is in this way made to reproduce exactly the first three orders of colours of Newton's rings, but divided into the precise tints over narrow strips. A detailed account is also given of the combinations devised by Norremberg and Reusch for reproducing the phenomena of uniaxial crystals and of quartz by the superposition of thin films of mica crossed in various ways. Plates illustrative of these combinations contribute much to the value of the descriptions and explanations of the text. Mr. Wright also gives some account of his own researches upon the spiral figures produced by the introduction of quarter-undulation plates into the polariscope in which crystal sections are being examined by convergent light. There is a penultimate chapter on the polarisation of the sky and of minute particles, followed by a final chapter—wholly out of place in such a work—in which, so far as it is intelligible, there appears to be an attempt made to connect the undulatory theory of light with the trinitarian theory of theology. With the exception of this last, and with a few occasiona inelegancies of style, there is little fault to find with the book. The mathematical student of optics will without doubt grumble when he takes up the work, because the mathematical aspect of the subject is conspicuous by its absence. The author does not profess to be a mathematician : or he would hardly have pronounced in favour of Brewster's views on the theoretical polarising angle, as he does on p. 223. This, however, is a minor matter in a book whose great aim is to assist manipulation. The numerous illustrations, a large proportion of which are original, add greatly to its value. The coloured plates of polariscopic phenomena are, it should be added, of singular excellence. S. P. T.

OUR BOOK SHELF

Practical Chemistry, Analytical Tables, &c. By J. Campbell Brown, D.Sc. (London : Churchill, 1882.)

NOTHING perhaps is more remarkable than the great increase during the past few years in the number of books on practical chemistry and analysis. This has no doubt to some extent been caused by the prominence given generally to the teaching of chemistry in the laboratory.

The books to which we refer consist with few exceptions of tabular statements of reactions of acids and bases and methods of detection of the same in simple salts or mixtures. They all appear to be on the same "type" and with the same intention of putting students through a course of drudgery in qualitative analysis according to a fixed "table." The book before us is no worse than others of its class, but attempts rather too much by giving

condensed tables for alkaloids and gases, which are, however, in themselves very good ones. It is to be feared that these practical books tend to make students mere analytical machines in a small way, without giving them much real practical notion of chemistry. It is questionable whether a student who has worked through the modern tabular system of practical chemistry would be able, for instance, to state the reason for the employment of bricks in preference to chalk for the back of an ordinary fireplace or some equally simple practical question.

Elementary Chemical Arithmetic. By Sidney Lupton. (London: Macmillan and Co., 1882.)

THIS little book with its modest preface will be recognised by all teachers of chemistry, especially in large laboratory classes, and also by students as a really useful adjunct.

Unfortunately in large public laboratories a considerable proportion of the students have been very much neglected in the matter of their elementary mathematical education, or it has been of such a nature that they are not able to apply it to the solution of ordinary chemical problems, thus entailing, in many cases, a large amount of extra work and loss of time on the part of the teacher in giving instruction in elementary arithmetic. This book fits into its place exactly. It is divided into two main portions: an introduction, consisting of short but very understandable explanations of arithmetical processes in common demand in chemistry and physical chemistry of a practical and elementary nature, the second portion being problems divided under the headings of the different elements. Regarding these it may perhaps be said that they do not err on the side of being too chemical, and in one or two cases more attention has been given to the question as a question than to its absolute chemical correctness, but these are mere details that in no way detract from the utility of the book for its purpose.

What is required of the mass of chemical students is that they should be able to apply methods of reasoning founded on experimental facts in the science to the solution of concrete and abstract problems; and working through this book will certainly conduce to bring about an improvement in that direction.

The Watch and Clockmaker's Handbook. By F. J. Britten. (London: Kent and Co., 1881.)

THIS little book has been written, we are informed, chiefly for the instruction of country watchmakers. It cannot fail to be agreeable to them: it contains a great deal of useful practical information, and some is given of a higher quality, such as workmen are, to their credit, eager for now-a-days. To another and wider circle there is also much of a character to be interesting. The book is a proper supplement to the more popular horological treatises. There are good descriptions and pleasing diagrams of the various watch escapements; there is a chapter upon the art of springing; the mechanism of chronographs, repeating watches, and calendars is shown, but almost too briefly. Lastly, we find pictures and a short reference to the various tools which watchmakers employ, and some serviceable memoranda are added. Upon the whole the author has and deserves our praise.

H. DENT GARDNER

Heroes of Science. Botanists, Zoologists, and Geologists. By Prof. P. Martin Duncan, F.R.S., F.L.S. (London: The Society for Promoting Christian Knowledge, 1882.)

THIS little volume contains brief sketches of the lives of a few botanists, zoologists, and geologists, for the most part acknowledged compilations from well-known sources. No doubt the work will serve the purpose for which it is evidently intended—that of interesting young people in science.

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. No notice is taken of anonymous communications.*

[*The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to ensure the appearance even of communications containing interesting and novel facts.*]

Physics of the Earth's Crust

ON March 23 last Prof. Green sent to NATURE some remarks upon Mr. Hill's review of my "Physics of the Earth's Crust." More lately the third edition of his "Physical Geology" has appeared, in which he has repeated the substance of a part of what he then wrote. On account of the great weight which his authority will carry, I think I should offer some reply.

He truly says at p. 674, that I claim to have proved that the contraction of the earth through cooling cannot have caused the amount of squeezing and elevation which has taken place, and that the hypothesis is therefore insufficient to explain the facts which it professes to account for; but he then adds: "What Mr. Fisher has really done is this. His calculations go far to prove that, provided the earth cooled in the way assumed by Sir Wm. Thomson, contraction would not suffice to produce anything like the compression and elevation that has actually occurred. But this is quite another thing from disproving the contraction hypothesis. Mr. Fisher's investigations tend rather to establish a strong probability that the earth did not cool in the way supposed by Sir Wm. Thomson,"—that is, that it became solid throughout in a comparatively short space of time. But of course my calculations do not establish any probability against this way of cooling, unless we begin by assuming that contraction through cooling has been the cause of the elevations. And that seems to be begging the question. What they do prove is that the contraction hypothesis will not account for the elevations if the earth has cooled as a solid.

But there may have been another way of cooling which, on geological grounds, I believe to have beeen the true one. The earth may not have become solid throughout in a short space of time, and may not be solid even now. In that case the crust, whose corrugations we have to account for, must have floated on a denser liquid substratum. Under these circumstances every elevation above the mean level must have had a corresponding protuberance answering to it below. This is necessary, as was long ago pointed out by Sir G. B. Airy. I have, then, proved that, this being so, if the crust beneath the ocean is of the same density as beneath the continents, on what I conceive to be reasonable assumptions regarding the thickness and density of the crust and the density of the substratum, a shortening of the earth's radius by less than 700 miles would not have sufficed to produce the existing inequalities. I can imagine no theory of the constitution of the interior that would admit of so large an amount of contraction taking place, after the whole had become sufficiently cool for a crust to have begun to be formed, as to cause such an amount of shortening as this.

If, however, we suppose that the crust beneath the oceans is denser than that which forms the continents (and I have given several reasons for believing such to be the case), then a much smaller amount of radial shortening would suffice. I have estimated it at about forty-two miles. Still, anything near this shortening is far beyond what any reasonable amount of contraction from cooling could produce. For if there be a liquid substratum this must be of nearly equable temperature throughout, and that cannot be much above the temperature of solidification; so that it does not appear how a much greater contraction can be got out of the gradual solidification, and incorporation of the upper parts of the liquid layer with the crust, than could be obtained on the former supposition of a cooling solid globe; and I have shown that, in that case, the radial shortening would be less than two miles.

Thus, then, I claim to have disproved the contraction-hypothesis under the two alternative hypotheses (1) of a solid globe, and (2) of a liquid substratum.

Capt. Dutton, of the United States Geological Survey, has said of this part of my work, "First and foremost he has rendered most effectual service in utterly destroying the hypothesis, which attributes the deformations of the strata and earth's crust to interior contraction by secular cooling. No person, it seems to me, can sufficiently master the cardinal points of his

analysis, without being convinced that this hypothesis is nothing but a delusion and a snare, and that the quicker it is thrown aside and abandoned the better it will be for geological science" (*American Journal of Science*, vol. xxiii. p. 287).

I take this opportunity of pointing out a mistake in my book. At page 156 the number 1127 ought to be 1734; and consequently the number 0·996 ought to be 0·965. The argument will still hold. O. FISHER

Harlton, Cambridge, November 9

P.S.—Since forwarding the above I have observed a note at p. 912 of Dr. Geikie's "Text Book of Geology," in which he says that I have "endeavoured" to show that the secular contraction of a solid globe through mere cooling will not account for the phenomena. The word "endeavoured," does not express the attitude of my mind upon the question. Forty-two years ago the contraction theory occurred to myself independently. I remember that in my youthful joy at what I thought thought a discovery, I forthwith vaulted over a gate! In 1868 I read my paper on "The Elevation of Mountains by lateral Pressure," fully believing that I was elucidating the cause which had produced them in the contraction through secular cooling. In 1873 I began my paper on "The Inequalities of the earth's Surface viewed in connection with the Secular Cooling," while still under the same impression. I first of all estimated the actual elevations, and, this done, I calculated the amount of those which would be formed upon Sir William Thomson's view of the mode of solidification. To my excessive surprise, the result showed the utter inadequacy of the contraction hypothesis. I thought I must have made some error in the calculations, but could find none. I still, however, adhered to the original idea of contraction, and suggested, towards the end of that paper, a fluid condition of the interior at some *former* period, thinking that sufficient contraction might be perhaps obtained by that means; for I had not yet dared to question Sir Wm. Thomson's dictum of the *present* complete solidity of the earth. It was not until about a year ago, when I wrote the chapter in my book about the "Amount of Compression," that I perceived that even the condition of a liquid substratum would not give the necessary degree of contraction to produce the compression. I have thus been driven from the contraction hypothesis step by step, and have by no means been endeavouring to support a preconceived opinion against it.—O. F.

Shadows after Sunset

HAPPENING by chance to look into "Loomis's Meteorology," after reading M. Dechevren's account of the blue, white, and red bands visible before sunrise and after sunset at Zikawei, I noticed under the above heading the following account of shadow-bands, which not only appear to be very similar to those observed by Dechevrens, but are explained in identically the same way ("Loomis's Meteorology," p. 107): "A similar phenomenon [to the water-bands described in the preceding paragraph] is frequently noticed about fifteen minutes after sunset, when the shadows of clouds near the horizon are projected upon the western sky in the form of radiant beams diverging from the sun. These beams are parallel lines of indefinite length, but from the effect of perspective they seem to diverge from the sun, and if they could be traced entirely across the sky, they would for the same reason converge to a point directly opposite to the sun. Such cases are sometimes, though not very frequently noticed. Similar shadows are sometimes seen in the morning before sunrise, and form a conspicuous feature of the morning twilight. This effect is sometimes noticed in nearly every part of the world. It must have attracted the attention of the ancient Greeks, and is thought to explain that poetic expression "the rosy-fingered dawn."

M. Dechevrens appears to think the phenomenon does not occur in Europe or temperate latitudes generally, but from what Loomis says, one would infer that he may be mistaken in this, and that to a modified extent it may be visible in Europe and America. Perhaps some of your readers who are in the habit of observing the face of the sky will be able to verify this supposition. For my own part I have not remarked it in England, but have occasionally witnessed it in Bengal during the rains, very markedly. The explanation offered by M. Dechevrens seems the only reasonable one under the circumstances, but he hardly seems to lay sufficient stress upon the fact that when the sun is below the horizon his rays can only illuminate a shallow stratum of partially condensed vapour in the upper atmosphere. Any obstruction of his rays will consequently shut off the *whole* of the reflected light from this stratum, and cause the blue sky to appear through the shadow, all the more cerulean by contact with the whitish or rosy colour of the adjacent portions which still bask in the solar rays. E. DOUGLAS ARCHIBALD

An Abnormal Fruit of Opuntia Ficus-Indica

THE accompanying figure represents a fruit of *Opuntia Ficus-Indica*, which is wholly inclosed in one of the well-known flat branches of this plant; normally the fruits appear as exserted obovate bodies on the margin, or on either side, of the branches. The figure is exactly half natural size; the fruit is therefore full grown. There is no interruption in the ascending curves of spinous tubercles, only they are somewhat smaller on the fruit, which has also a less wrinkled skin than the remainder of the branch. It is of rather uncommon occurrence, nobody having seen here anything alike in the extensive *tunales* or Indian fig-plantations of our neighbourhood; nor have I been able to find any mention of such a case in the books at my disposal. It is evidently an instance of non-development of peduncle, a special case of suppression of axile organs (Masters, "Teratology," p. 393). But I think it throws also some light on the nature of what generally is taken to be the pericarp of the Opuntia fruit, which, after all, seems to be a slightly modified branch, bearing the ovary of the flower in a cavity on its

Abnormal Fruit of *Opuntia Ficus-Indica* from Carácas.

upper end. A similar view is held forth by Dr. Noll in a paper published in the *Annual Report* of the Senkenbergische Gesellschaft (Frankfurt, 1872, pp. 118-121, with two plates), where he describes and figures two abnormal fruits of *Opuntia coccinellifera* from the Canary Islands, with branches growing from the exterior part of the fruits. Their apparent pericarp is therefore an axile organ of a certain order, say of the order n, whilst the additional branch is of the next order, $n+1$. The case which forms the object of the present note is quite the reverse of those mentioned by Dr. Noll, as the branch of order n, or the exterior part of the normal fruit, is not developed independently, being represented by its parent-branch of order, $n-1$.

If this view be correct, there can no longer be any reason for speaking of an *exserted ovary* in Opuntia (Hooker and Bentham, "Genera plantarum," I., 851), as this organ is wholly sunk in the interior of a branch, just as it happens in other Cacteæ with an *ovarium immersum*. A. ERNST

Carácas, October 4

The Comet

THANKS to the entire absence of twilight, and to a beautifully clear sky, I obtained a splendid view of the comet on November 14, 15h. 45m. The tail had a length of 30°, and was divided into two portions at the extreme end, the northern extremity curving very sharply upwards, and separated from the southern branch by a semi-circular space. The general form of the tail being very similar to the Greek character γ. The southern side still remained brighter than the northern. The nucleus was much more elongated than when I observed it on November 8. The two concentrations of light which were very noticeable on that date, were not now so conspicuous, being smaller and much closer together, so much so, that had the definition been otherwise than perfect the division between them could not have been seen. As showing the necessity of observing this interesting object in the absence of twilight I may mention that by 17h. 45m. G.M.T., the apparent length of the tail was reduced to 20°.

B. J. HOPKINS

79, Marlborough Road, Dalston, E., November 20

Soda Flames in Coal Fires

IF a coal-fire be looked into with some attention after a fresh supply of coals has nearly ceased to give out its gases, there will be seen here and there in the hottest parts, and coming out of them through crannies and round dark corners, a pale translucent yellow flame, which one soon gets to recognise easily. What does it consist of? If looked at through a prism, without any slit screen, this flame is at once seen to be monochromatic. Neither its shape nor brilliancy (in which it is deficient) are at all altered or impaired; and it is especially interesting on this account, as there is something uncanny in the appearance of this pale flame defying the power of the prism, as it flickers aad plays about the brilliant spectrum representing the red-hot coals.

Coals vary much in their possession of the source of this flame. In some it seems scarcely present at all, while in others it is abundant, being recognisable even in the large surface-flames. The coal in which I have seen it best, is a close hard coal, with a slaty cleavage and rectangular fracture, known, I am told, as "Anchor Brights" (?) The yellow flame appears frequently even in the largest surface ones, when the gaseous products first disengaged have disappeared. Some of them seem, then, to consist entirely of this, giving little or no continuous spectrum. But it is in the body of the fire that it is most fascinating, imparting a reality to the otherwise confused forms, which is more than pretty. I am strongly reminded by this appearance, when, for instance, a black mass is seen to stand out with a clear outline against the pale yellow background of light, of the picture which was mentally present in the days before the solar eclipse of 1868—the first upon which the prism was brought to bear. I have fortunately found a copy of some "Instructions" issued on the occasion of distributing the "hand-spectroscopes" provided by the Royal Society for the study of that eclipse; in which this prognostication is indicated with quite as much precision as the known facts at that time warranted. That it was not fully understood was the only reason why the moon was *not* seen, as it might have been seen, on that memorable occasion, sharply outlined upon the coronal light, just as I now see the coal. This was long before the time when the same arrangement on a larger scale—a prism in front of the object-glass of a telescope—obtained such success in other hands. However that may be, the coal-fire experiment is a very pretty one, and might be made very instructive too as a drawing-room illustration—the ordinary prismatic pendants of a chandelier being quite equal to the occasion, if a direct-vision combination is not immediately available.

J. HERSCHEL

30, Sackville Street, W.

P.S.—As the monochromatic light—of sodium, of course—is plentiful in the large flames, it will be well seen as a *line*, straight or curved, if the light of the fire on a cylindrical or curved metallic or other reflecting surface be looked at, especially if dark coloured; such as an ebonite ruler, for instance. Of course a direct-vision pocket spectroscope is better than the pendant of a chandelier; but the lenses must be taken off, as well as the slit-screen.

Complementary Colours —A Mock Sunset

INSTANCES of two phenomena recently noticed in NATURE have chanced to come under my observation, and in each case impressed me much with their beauty and distinctness; the first, an effect of contrast of colour on the surface of clear water. Standing looking up stream on a bridge over the Ary, where it flows through meadows close to Inverary Castle, and admiring the transparent brown hue so often seen in the peat-stained waters of Scotch streams, my attention was attracted by a series of wavelets forming a ridge, somewhat spiral in appearance, across the stream, along the top of a low weir over which the water falls. Every single wave presented on its further surface (that seen foreshortened by the spectator) a nearly level space of pure full-toned amethyst colour, while its advancing front showed with crystalline transparency the deep "cairn-gorm" or burnt sienna tint proper to the water. The regular alternation of these patches of rich and brilliantly-contrasted colours, together with their permanency and apparent independence of anything peculiar in the state of the atmosphere, produced a striking and very beautiful effect.

The phenomenon of a mock sunset in the east I witnessed in great perfection on the Lake of Lucerne, when the whole eastern sky was traversed by broad rose-coloured bands converging from the north, south, and zenith towards a point opposite the sun.

I. H.

A Lunar Halo

LAST evening, about 7.15 p.m., a lunar halo of a peculiar character was seen here. It was at some distance from the moon, and instead of being, as usual, concentric with this body, was of an oval, or, more strictly speaking, a horse-shoe shape, the lower part of the halo not being complete. The moon, too, was not in the approximate centre of the horse-shoe. Supposing its distance from the vertex to be represented by the quantity 1, 2½ would represent its distance to the lower part of the halo. Some heavy mist-clouds lay under the moon, which thinned out and became more transparent upwards, and refraction from the dense parts of these may have been the cause of the curious distortion of the circle in this case.

J. RAND CAPRON

Guildown, November 21

A Correction

PERMIT me to correct an error which appears in your report of "The Additions to the Zoological Society's Gardens" (NATURE, vol. xxvi. p. 232). Your reporter states that one of the parrots presented by me is a "New Zealand parakeet (*Cyanorhamphus novæ-zealandiæ*"). The bird I sent is *Cyanosaisseti*, Verr., from hence (New Caledonia), and, according to Dr. Sclater's published catalogue, has never been in the Gardens. It differs—as I have already pointed out—from *C. novæzealandiæ* in size, extent of markings, but especially in the shape of the tail feathers (*Cf. Ibis*, vol. 1879, pp. 109 110). It is one of a small group of parrakeets that is found in New Zealand, Chatham Island, Norfolk Island, and here, closely resembling each other, but at once separable when seen together. Neither this, nor *Nymphicus uvæensis*, Layard, which is a new species just described by me, has ever been seen in Europe before, that I can learn.

E. L. LAYARD

British Consulate, Noumea, September 7

[The Secretary of the Zoological Society informs us that Mr. Layard is quite right in his remark, but that the bird has been long since correctly named, and will be shortly figured in the Zoological Society's *Proceedings* under its proper name.—ED.]

Thomson's Mouse-Mill Dynamo

ALLOW me to make a slight but important correction on your description, in last week's NATURE, of Sir William Thomson's *mouse-mill* dynamo. In your description it is said that "at one end of the hollow drum these copper bars [the mouse-mill bars] are united to each other in pairs, each to the one opposite it." This is not so. At one end of the hollow drum the ends of the copper bars are *all united together*, "metallically connected by soldering or otherwise." The effect is electrically the same as that of the arrangement described in your article; but, in the construction of the machine, the uniting of all the bars together at one end, instead of joining them in pairs, is so much more simple and easy that the correction seems of importance.

J. T. BOTTOMLEY

The University, Glasgow, November 18

"Weather Forecasts"

I HAVE recently designed and patented "An improved floating vessel for automatically compressing air by the action of the waves of the sea, and also for the generation of electricity by the agency of this compressed air." This vessel is capable of being moored in 1000 fathoms, and can be connected with the shore by means of an insulated electric cable. Such a vessel moored in the mid-Atlantic in the usual track of the cyclones which approach these islands from the west, would be of immense advantage to the Meteorological Office in determining the velocity of advance and direction taken by these cyclonic centres. I purpose exhibiting a model and drawings of the vessel at the Winter Electric Exhibition, to be held at the Westminster Aquarium next month. CHARLES W. HARDING

King's Lynn, November 14

Age of Dogs

I AM acquainted with a black retriever dog aged thirty-one years, and should like to know whether this age is often attained by dogs. R. CORDINER

Oxford, November 15

Waterspouts on Land

WHEN on a fishing expedition this year, in the mountainous district of Minnigaff, in this country, my attention was drawn to the effects of two waterspouts, which had taken place, one in July last, and the other some six months previously. The effects of both are to be seen in the faces of two mountains a mile apart. One is on a hill-farm called Blac Klaggan, about 100 yards above a mountain-stream, where an excavation, by the force of the spout, had been made to the depth of ten or twelve feet, and about twenty yards wide. Stones—boulder-stones from 10 cwt. to 3 tons, were spread out, in the course of the torrent, down to the "burn," which runs below—one boulder, lying in the bed, being quite 3 tons weight. The other waterspout had struck on *White Laggan*, on a steep mountain side, facing the upper part of Loch Dee. It was higher up on the hill, and had cut to the depth of about 15 feet, and was 10 yards wide, scattering the earth and boulders before it, to a distance of 150 yards below, and spreading out the smaller stones and gravel over a flat moor, in varied tracks, more than 100 yards further. I have not heard of anyone who saw either waterspout, and both are supposed to have taken place at night. All the other parts of both mountains are covered with heather and grass, above, on each side, and below, except in the direct course cut by the torrent from each waterspout. No one remembers any previous case of the sort in the district. Perhaps some of your readers can give other instances of this kind, and some information that may prove interesting and useful. JAMES HOSACK

Ellerslie, Kirkcudbright, N.B., November 13

METEOROLOGY OF THE MALAY ARCHIPELAGO[1]

THE two systems of meteorological observations carried on under the direction of the late Dr. Bergsma present us, in these two serial publications, with what must be classed among the most remarkable contributions made in recent years to observational science, and they are all the more valuable on account of the new and exact information they give as to the different climates of the Malay Archipelago, about which so little was previously known.

The first and longest continued series of observations made at the observatory at Batavia take rank among the very best yet made. They embrace hourly observations for the fifteen years ending with 1880, of atmospheric pressure, temperature, humidity, rain, wind, cloud, &c., which have been published *in extenso*. During the first thirteen years the records consisted wholly of eye-observations, but from the beginning of 1879 the observations were made by photographically and other self-recording instruments. In vol. v., in addition to the hourly observations for 1879 and 1880, there is given a discussion of the fifteen years' observations, which from the excellence of its design and execution, represents the meteorology of Batavia with a fulness and completeness at least equal to what has yet been done for any other place on the globe.

Among the more interesting results, those of the rainfall may be pointed to, particularly the tables showing the mean amounts for the different hours of the day. These reveal two daily maxima and two minima. The larger maximum occurs from 2 to 7 p.m., when 32 per cent. of the whole daily fall takes place, and the larger minimum from 6 to 11 a.m., when only 13 per cent. of the daily amount falls. The smaller maximum is from 10 p.m. to 2 a.m., when 17 per cent. falls, and the smaller minimum during the two hours from 8 to 10 p.m., when 7 per cent falls.

The most remarkable, if not the most important of the results arrived at are perhaps those referring to the influence of the moon on the pressure and temperature of the atmosphere and the rainfall, which establish the fact of a distinct lunar atmospheric tide. Assuming the lunar day to commence with the time of the upper transit of the moon, the following are the phases above or below the mean expressed in millimetres :—

	mm.		
1st max.	+0·057	at lunar hour	1
,, min.	−0·053	at ,,	7
2nd max.	+0·064	at ,,	13
,, min.	−0·060	at ,,	19

The lunar tide has been determined for each of the four quarters, and also at perigee and apogee, and the results show differences of great interest. As regards the rainfall, while the mean amount in 24 hours during the 17 years ending with 1880 was 5·19 mm., at the time of new moon there was a mean excess of 0·94 mm., and at full moon also an excess of 0·19 mm., but on the other hand, at the third octant there was a deficiency of 0·61 mm., and at the fifth octant also a deficiency amounting to 0·55 mm.

The result is that the atmospheric pressure at Batavia has a lunar daily tide quite as distinctly marked as the ordinary diurnal barometer tide, except that its amplitude is much less, the lunar daily tide being as compared with the mean solar daily tide nearly in the proportion of a millimetre to an English inch. The lunar tide has also the important difference in that its phases follow the moon's apparent course much more closely than the diurnal barometric fluctuations follow that of sun. The two maxima occur about the 1st and 13th, and the two minima about the 7th and 19th lunar hours, whereas these four daily phases of the diurnal barometric fluctuation occur with respect to the sun's apparent course from one to six hours later. The influence of the moon's phases on the rainfall is quite decided ; for while the mean daily rainfall is 0·205 inches, it rises at full moon to 0·248 inch, from which time it gradually falls to 0·181 inch at the third octant, rises to 0·212 inch at the fourth octant, then falls to 0·184 inch at the fifth octant, and finally rises gradually to the maximum at the time of new moon. The important conclusion follows that the attractive influence of the moon, and consequently that of the sun, must be taken into account as factors concerned in bringing about oscillations of the barometer. In this connection it is interesting to note that in the higher latitudes in inland situations during winter, or at times and situations where the disturbing influences of temperature and humidity tend towards a minimum, the times of occurrence of the four phases of the daily oscillation of barometer approximate to those of the daily lunar atmospheric tide.

The second series of observations, giving the rainfall for the three years 1879, 1880, and 1881, form an extremely valuable contribution to our knowledge of the climates of

[1] Observations made at the Magnetical and Meteorological Observatory at Batavia, 1866 to 1880. Regenwaarnemingen in Nederlandsch-Indie, 1879-80-81. Door Dr. P. A. Bergsma, Directeur van het Observatorium te Batavia.

the Malay Archipelago. This network of rainfall observation now includes 150 stations scattered over the islands at heights varying from near sea-level up to 6404 feet. The averages of the three years show that the mean annual rainfall over the archipelago varies from about 60 inches in Timor to upwards of 200 inches at some spots among the western slopes of Sumatra. But the determining character of the rainfall, as regards the climates is not the absolute amount that falls annually but rather the manner of its distribution through the months of the year. Over the larger proportion of the islands rain falls copiously every month of the year; but as regards some of the islands, the year is divided into dry and wet seasons as markedly as is seen in the climates of India.

The reason of this difference is readily seen on examining the distribution of atmospheric pressure during the months from Australia to China with the prevailing winds resulting therefrom. During the winter months pressure is high in China and low in the interior of Australia, the mean difference being nearly three-quarters of an inch. Between the two regions the fall is practically uninterrupted, and the Malay Archipelago lying between them is swept by northerly winds. Since these winds have traversed no inconsiderable breadth of ocean, they deposit a copious rainfall particularly on the northern slopes of the higher islands, and consequently the rainfall of these months is large over all the islands without exception, the mean monthly amount in some places exceeding 30 inches. It is to these same winds that the north of Australia owes its rainfall; and it is their strength in any particular year which determines the distance to which the annual rains penetrate southwards into the interior of that continent.

On the other hand, during the summer of the northern hemisphere, atmospheric pressure is high in the interior of Australia, and low in China, the mean difference being aboot half an inch, and between the two regions the fall in the mean pressure is continuous and uninterrupted, and consequently southerly winds prevail over the intervening region. These winds are dry and absolutely rainless over the north of Australia, and over Timor and the other Malay islands, which are separated from Australia but by a comparatively narrow belt of sea. During the three years no rain whatever fell at Timor during July and August, and the fall was small during June, September, and October. As the winds pursue their course to northward, they eagerly lick up moisture from the sea, so that by the time they arrive at Amboyna they have become so saturated with moisture that the monthly rainfall of that place rises at this time of the year to nearly 30 inches. At some distance to the west of Timor rain falls at this season more or less regularly every year, the amount increasing in proportion to the extent of ocean traversed by the south-east winds, which blow towards the islands from the direction of Australia. These marked and vital differences of the climates of the Malay Archipelago, which, as they depend essentially on the geographical distribution of the land and sea of this part of the globe may be regarded as permanent, have played no inconspicuous part in the remarkable distribution of animal and vegetable life which characterises the archipelago.

THE COMET

THE receipt of observations from Australia, made between September 8 and 16, has allowed of the determination of the orbit of the present comet exclusively from positions obtained before the perihelion passage when it made so close an approach to the sun. From a mean of the Melbourne and Windsor N.S.W. observations on September 9, and the Melbourne meridian observations on September 14 and 16, Mr. Hind has deduced the following orbit:—

Perihelion passage, Greenwich M.T., Sept. 17·21897

Longitude of perihelion	275° 50′ 20″
Ascending node	345 53 2
Inclination	38 0 17
Log. perihelion dist.	7·8501274

Retrograde.

The longitudes are reckoned from the apparent equinox of September 17, and it should be mentioned that the small corrections have been neglected. On comparing the observed places with those calculated from the elements founded upon observations before perihelion, the following differences remain:—

		$\Delta\alpha.\cos\delta\,(c-o)$	$\Delta\,\delta$
		″	″
Tebbutt	Sept. 8	− 25	− 3
Tebbutt and Melbourne	,, 9	0	0
Melbne. merid.	,, 14	+ 21	+ 7
,,	,, 15	+ 5	+ 5
,,	,, 16	+ 1	0
A. Common ...	,, 17	+ 12	− 4

When however we compare with the meridian observations at Dunecht and Coimbra on September 18, or the day after the comet's close approach to the sun, the computed place is found to differ by several minutes of arc from that observed, and at the time when Mr. Gill noted the comet's ingress upon the sun's disc, calculation places it 2′ 30″ within his limb. These differences appear to point to sensible perturbation about the perihelion passage, but a stricter discussion of observations before and after the time when the comet attained that position in its orbit, will be needed before any reliable judgment on this important question can be formed. It may be noted also that a very small change in the time of perihelion passage has a comparatively large effect upon the geocentric positions about that epoch.

Mr. W. F. Denning communicates the following estimates of the length of the tail of this comet made by him at Ashley-down, Bristol; the dates are astronomical:—

Oct. 1 ... 10	Oct. 30 ... 22	Nov. 8 ... 23
,, 11 ... 15	Nov. 5 ... 23	,, 9 ... 22
,, 25 ... 19	,, 6 ... 23	

To form an idea of the real extent of the tail, assume it first to be situate in the direction of the radius-vector, as is most frequently the case. At 6 a.m. on November 7, by the orbit last published in NATURE, the distance of the comet's nucleus from the earth (expressed in parts of the earth's mean distance from the sun) was 1·4844, and its distance from the sun was 1·4958, the earth's radius-vector being 0·9005. Hence we find the angle at the comet between lines supposed to be drawn to the earth and sun respectively was 38° 49′, from which it appears that an angular extent of 23° would give a real length, as a prolongation of the radius-vector of rather over 196,000,000 miles. But this must be an outside estimate of the linear distance of the extremity of the tail from the nucleus, as there was sensible curvature of the tail, the effect of which may be readily seen by a graphical process upon the above data.

We subjoin the Melbourne meridian-observations, to which reference has been made:—

	Melbourne M.T. h. m. s.	Apparent R.A. h. m. s.	Apparent N.P.D. ° ′ ″
Sept.	14...23 10 13·7 ...	10 45 53·34 ...	89 55 47·1
	15...23 22 36·6 ...	11 2 14·89 ...	89 29 39·2
	16...23 39 0·3 ...	11 22 37·75 ...	88 47 55·2

The observation of September 15 was made with great difficulty, the comet being obscured by cloud.

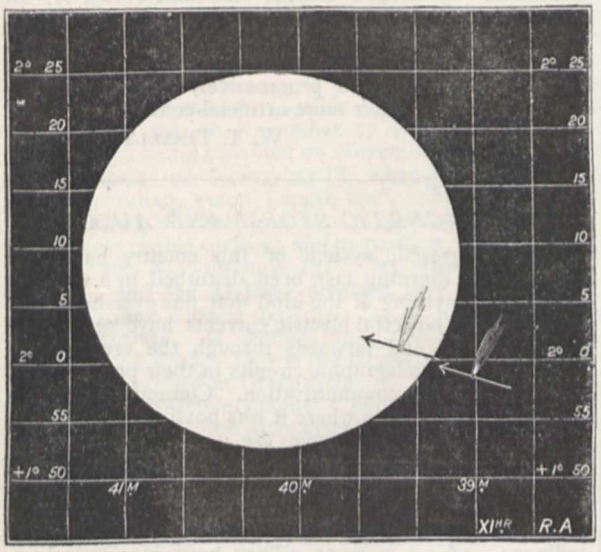
THE following communications speak for themselves :—

Columbia College, New York, November 4

DEAR SIR,—I have received the inclosed communication from Prof. Chandler, of Boston. The letter may interest your readers. J. K. REES

Harvard College Observatory, Cambridge, October 28

DEAR SIR,—Your note of the 26th inst. was duly received. I respond cheerfully to your request, although as I have but a quarter of an hour at my disposal, I trust you will regard my answer as furnishing in a disconnected form the principal points in the results so far reached by me, and will bear in mind that I have not had an opportunity to arrange them in a more formal shape. Of course the most interesting point in connection with this comet, astronomically, is the opportunity afforded to decide the question of the disturbance which a comet will experience in passing through the coronal regions in the close vicinity of the sun. Of all the comets which have passed near enough to be disturbed by this cause, this is the only one which has been observed on both sides of perihelion. Not to mention others, the comets of 1680, 1843, and 1880, all of which present such close resemblance to



Ingress of Gould's Comet upon Sun, September 17, 1882.

the present comet, as to have raised in some quarters the question whether they are not, in fact, returns of the same body, were observed, either insufficiently to decide this question of disturbance in the sun's upper atmosphere, or were observed only on one side of perihelion.

In the case of this comet, however, there will be available a very extensive series of accurate observations at the Cape of Good Hope from September 8 ; almost continuously up to within two hours of perihelion passage, ceasing only with the ingress of the comet upon the sun's disc, the instant of disappearance being accurately observed; an observation unparalleled in astronomical history, and of the greatest value. The comet was also observed at Rio Janeiro on September 11, and probably followed up to perihelion.

I have also received from Dr. Gould a private letter dated September 15, on other astronomical matters, at the end of which he states incidentally that a brilliant comet had been visible there "for more than a week, of which he had two observations, and was awaiting clear weather, in order to observe it in the meridian." Thus in all probability he was the first to descry the comet, as, by a curious coincidence, he was the first to see the one, which so closely resembled it in 1880.

After perihelion of course there exists, and will be accumulated hereafter, an abundant body of data to fix its orbit, after emergence from the coronal regions. Of all the observations before perihelion, we are in possession as yet only of a position on September 8 at the Cape of Good Hope, the time of ingress upon the sun's disc on September 17, and Mr. Common's observations on September 17. The last, Mr. Common's, I have not yet examined ; but from the others I have been led to conclude that little if any disturbance could have been caused by resistance experienced in the sun's atmosphere, so to call it, for the sake of convenience.

The grounds of this conclusion are the following :— Taking all the observations available about a week ago, others have come to hand since, and verify the calculation, although they could not be used in it, which were made since perihelion passage, *i.e.* from September 18 to October 20, I first computed an orbit from normal places, assuming the orbit to be a parabola, with the following results :—

1882.

T = Sept. 17·22013 Greenwich M.T.

$$\left.\begin{aligned} \pi &= 55^\circ\ 22'\ 26''{\cdot}8 \\ \omega &= 69\ 28\ 46{\cdot}4 \\ \Omega &= 345\ 53\ 40{\cdot}4 \\ i &= 141\ 55\ 15{\cdot}0 \end{aligned}\right\} 1882{\cdot}0$$

$\log. q = 7{\cdot}8915778$

The deviation of the middle place $(c-o)$ was $+18''{\cdot}8$ in longitude and $+8''{\cdot}8$ in latitude. It was very plain that the observations could not be satisfied better than this by any parabolic hypothesis. I accordingly computed an elliptical orbit as follows :—

T = Sept. 17·2304 Greenwich M.T.

$$\left.\begin{aligned} \pi &= 55^\circ\ 12'\ 41''{\cdot}2 \\ \omega &= 69\ 22\ 7{\cdot}2 \\ \Omega &= 345\ 50\ 34{\cdot}0 \\ i &= 141\ 54\ 56{\cdot}2 \end{aligned}\right\} 1882{\cdot}0$$

$\log. q = 7{\cdot}8835636$

$e = 0{\cdot}9999700$

Notwithstanding the nearness to unity of the value of the eccentricity thus obtained, I believe that the ellipticity of the orbit is real, although the corresponding period is very long, something about 4000 years. Whether this is so or not is not of great importance as regards my present purpose. If now we take the observation of September 8, nine days before perihelion, and compare it with the places which are assigned by these orbits, we find that the difference is only $2\frac{1}{2}$ seconds in right ascension and something over 1′ in declination. Thus the differences (Computation—Observation) are for the

	$c-o$		
	$\Delta\alpha$.		$\Delta\delta$.
Ellipse	$-2{\cdot}5$s.	...	$+75''$
Parabola	$+2{\cdot}5$s.	...	$+95''$

quantities which are certainly not larger than the uncertainty of the calculation, that is, not greater than we ought to expect even if the comet had been subjected to no chance of disturbance.

Again, if we compute the place which would be assigned by the two orbits for the instant of ingress of the comet upon the sun on September 17, as observed at the Cape of Good Hope, and also the place of the sun, we have their relative positions as shown in the inclosed diagram, where the calculated places of the comet are indicated by the sign ♂ for the ellipse and parabola in red and black respectively, and the arrows indicate the direction and amount of the comet's motion in a quarter of an hour, as calculated by the orbits. It is significant that it would be necessary to assume a correction of only five or six minutes in either time of perihelion passage to bring the comet exactly upon

the sun's limb, where observations indicated it should be. As it cannot be considered that from present data we are certain as to the true time of perihelion passage within this amount, it seems that we have no reason to suppose that there has been any effect of retardation experienced. In fact the deviation shown by the ellipse is opposite to that which would have been the result of such retardation.

It should be remarked (as being of interest) that at the instant of entry upon the sun, the comet was about 1,600,000 miles from its surface (the true anomaly being about 90°).

The perihelion passage took place less than two hours after. The whole half circuit of the sun (from $v = -90°$ to $v = +90°$) occupied but $3\frac{1}{2}$ hours. It is certainly an interesting fact to consider, that an object of such limited dimensions and small gravity can pass at such an enormous velocity for hours through the sun's upper atmosphere, and emerge with so slight an effect on its motion as this body has apparently experienced.

An additional argument in support of my conclusion that little or no disturbance was suffered can be drawn from the fact that the comet, after passing this ordeal, is departing with nearly parabolic velocity, as the slight variation of the eccentricity from unity in the above elements proves.

Another interesting point which I would simply indicate, without discussing, is the bearing of the visibility of the comet clear up to the sun's edge. Prof. Pickering has suggested that the light which rendered it visible in this position must have been nearly all from the comet's own incandescence, scarcely any of it from reflection of the sun's light.

I think that the orbits which I have given may be considered as setting at rest completely the idea of identity of the present comet with those of 1668 and 1843. I say nothing of that of 1880, since there, although the hypothesis of its identity has been entertained in some quarters, it cannot for a moment be regarded as tenable. I have elsewhere shown that the deviations between the observations in 1880 and any hypothesis involving an ellipse of less than ten years' period for that comet, are too large to be considered for an instant as probable. The hypothesis of identity with comet 1880, I., may therefore be left to the sensation-mongers.

I inclose a copy of the *Science Observer Circular*, the regular issue of which will be out in a few days. The figures I have here given differ very slightly from those in the printed circular, but you may regard what I give in this letter as the latest. The elliptical orbit will dispose of the systematic deviations in the table (columns $o - c$) completely, and leave only the unavoidable observation errors.

You may make what use you please of this, except to treat it as a formally-prepared paper.

S. C. CHANDLER, Jun.

INFLUENCE OF "ENVIRONMENT" UPON PLANTS

IN the *Indian Forester* for July, 1882, Dr. Brandis, Director of the India Forest Department, has given the following interesting particulars as to the change in the season of flowering of the Australian acacias introduced in the Nilgiris:—

"*Acacia dealbata* was introduced on the Nilgiris before the year 1845. Col. Dun, the owner of many houses in Ootacamund, had planted several trees in his compounds, probably several years before 1845, but the tree was by no means common, and as late as 1855 was sold at the Government gardens, at two annas a plant. A curious fact regarding the flowering of this tree has been observed:—In 1845, and up to about 1850, the trees flowered in October, which corresponded with the Australian flowering time; but about 1860 they were observed to flower in September; in 1870 they flowered in August; in 1878 in July, and here, this year, 1882, they have begun to flower in June, this being the spring month here, corresponding with October in Australia. All the trees do not flower so early, because at various times seeds have been imported from Australia, and the produce of these would of course flower at the same time as the parent trees in Australia, until acclimatised here.

"Having watched the flowering of these trees for nearly forty years, there cannot be any doubt in the matter; and it is a curious fact that it should have taken the trees nearly forty years to regain their habit of flowering in the spring. Commencing in October, our autumn, it has gradually worked its way back to summer, and finally to spring; probably it will remain at this point."

I have tried to see whether any similar change of season could be traced at Kew.

Acacia dealbata can only be grown under glass with us. It forms a small tree in the Temperate House, and is a splendid object when in full flower. This usually takes place in early spring or towards the end of winter, say about February. Sir Joseph Hooker observed that *A. dealbata* and *A. decurrens*, var. *mollis* (which are closely allied species), flowered at the same time in Tasmania. In Aiton's Hortus Kewensis (1813, *A. decurrens*) is said to have been introduced in 1790 by Sir Joseph Banks, and to flower in May-July. The evidence, then, as far as it goes, would seem to indicate that the flowering time had also progressively worked back in England, though under more artificial conditions.

W. T. THISELTON DYER

THE MAGNETIC STORM AND AURORA

THE telegraphic system of this country has, since Friday morning last, been disturbed in a way that far exceeds anything of the kind that has ever happened before. Very powerful electric currents have been swaying backwards and forwards through the crust of the earth, taking all telegraphic circuits in their progress, and entirely stopping communication. Communication has been maintained only where it was possible to loop together two wires, so as to avoid the use of the earth altogether. The electric storm commenced on Thursday, but it reached its climax on Friday morning (November 17) between 10 and 11 a.m. The currents measured over 50 milliampères, which is five times greater than the ordinary working currents. They have repeated themselves at intervals ever since, but have scarcely attained such an intensity as on Friday morning.

Mr. Preece, whose experience in examining earth currents now extends over a period of thirty years, asserts that this storm was the most terrific he has ever observed. It was characterised on Friday by a rapid succession of alternate waves of great strength.

Both the storm and the aurora seem to have extended to America; the Philadelphia correspondent of the *Times* telegraphs under date November 19:—

"The electrical storm which began to derange the telegraph wires on Friday last still continues, though with less intensity. It spread through Canada and the greater part of the United States, as far west as Utah. The electricians say that the disturbance was unlike any heretofore known, acting upon the wires in strong waves, which produced constant changes in the polarity of the current. A magnificent aurora appeared on Friday night and was visible at all points, except where clouds obscured it. Cold weather, with snow, accompanied the storm in many places."

We have received many letters on the auroral phenomenon of Friday last; as introductory to these we give the following communication from Mr. W. H. M. Christie,

the Astronomer Royal, under the title of "Magnetic Storm, Aurora and Sunspot".—

A REMARKABLE magnetic storm, preceded by several days of considerable magnetic disturbance, was observed here on November 17. It commenced suddenly—November 16, 22h. 15m. G.M.T.—with a great decrease in all the magnetic elements, the declination being diminished by more than 1°, the horizontal force by more than 1-100th part, and the vertical force by nearly 1-100th part. From 4h. to 7h., and also from 11h. to 17h., the motions were large and violent, the range exceeding 2° for the declination, and 1-50th part for the horizontal and vertical force. Earth-current disturbances were also recorded, corresponding both in time and magnitude with the magnetic changes.

In the evening, as soon as it was dark, a brilliant aurora was seen, commencing with a bright glow of red light extending from the north and west beyond the zenith, interspersed with pale green phosphorescent light and streamers. At 6h. 4m. a very brilliant streak of greenish light about 20° long appeared in the east-north-east, and, rising slowly, passed nearly along a parallel of declination, a little above the moon, disappearing at 6h. 5m. 59s. in the west, about two minutes after it was first seen. The whole aurora had faded away by about 7h., but it burst out again at 11h. 45m., when an auroral arch, with brilliant streamers reaching nearly to the zenith, was seen from north-north-east to north-west. It faded away about 12h. 10m.

A remarkable sun-spot, visible to the naked eye, was seen on the sun on November 17 and following days, photographs being obtained on November 18, 19, and 20. Its dimensions on November 18, when it was near the central meridian, were: Length 194″, breadth 130″, area of umbra 735, of whole spot 2470 (expressed in millionths of the sun's visible surface), and its position: Heliographic latitude 19° N., longitude 121°. Its spectrum showed C, F, D_3, and the D lines reversed over the principal nucleus, C and F being extremely bright, and D_1, D_2, D_3 doubly reversed. It slightly diminished in size on the two following days. This is the largest spot that has yet been photographed at Greenwich.

Another very active magnetic disturbance commenced on November 19, soon after midnight, and at noon to-day (November 20) it is still in progress, all the elements being greatly disturbed. W. H. M. CHRISTIE

Royal Observatory, Greenwich, November 20

AN extensive aurora occurred last night, though I cannot pretend it was well seen here, both clouds and smoke preventing that. About sunset, and before any aurora had manifested itself, the smoke of the city was simply fearful on every side, rising in enormous volumes, through the calm air from a general bed or bank of it, blue gray below, brown above, that stood ten degrees high on every side in impervious thickness, as seen from the top of the Calton Hill. And no wonder that we neither imprison, nor even fine, those who wilfully thus besmirch the skies and poison the air of the people, when the chief offender was a chimney in the prison establishment itself; a chimney built like an ornamental watch-tower on a medieval Norman castle, but now sending up the most atrociously black column of pitchy coal smoke of all the chimneys around, and in vortex whirls that rose up to and fouled the very zenith sky; leaving in fact no portion whatever of the celestial hemisphere where a pure, unadulterated, and irreproachable optical observation of any astronomical phenomenon could be made, to compare with one through a natural, clear atmosphere of oxygen, nitrogen, and water gases.

About 8 or 9 o'clock aurora began to forcibly manifest itself, chiefly at heights of above 15° or 20°, smoke forbidding direct view lower down. Yet the aurora there must have been exceedingly bright, for the cirro-cumulus clouds above that elevation were often brilliantly illuminated from below, as by a morning dawn. The brightest displays occurred about midnight, and more in the north-east than the usual north-west direction. They seemed all to be of the usual monochrome, citron colour, and mostly took the form of needle-shape jets shooting upwards from a low, but broad circular arc, which they themselves assisted in forming; with this peculiarity too, that while no dark space was seen *below* the arc, as so often occurs, such a space, eminently and distinctly aurorally dark, was formed near the middle of the north-east arc itself, in the shape of a black break in that arch, of about five or six degrees wide, and sharply terminated on either side, while no other part of the sky, whether clear, cloudy, or smoky, could be called more than gray in its degree of darkness.

Auroras of one kind or another have been so frequent here for several weeks past, that, taken in connection with the many large sun-spots, I trust Prof. Simon Newcomb will be now quite satisfied touching the philosophic doubt he expressed a few years ago in his "Popular Astronomy," published during the dark, aurora-less nights of 1876–7. For he, at that time, hesitated to consider the past auroras of, and about, 1870 a consequence of, or anything more than a coincidence with, that maximum period of sun-spots; but showed his kindly feeling for the hypothesis by saying, that if the auroras became numerous again at the next maximum of sun-spots, the connection of the two phenomena would stand on a much surer basis.

Now sun-spots have been of late so large and frequent that I have had not a few letters and communications about them. The last such party was a brace of newspaper reporters, who came together, open-mouthed; for having heard from country correspondents that spots had been discovered by them with the naked eye on the sun, they came to ask me whether it could be true!

Wherefore I could only tell them that it was exactly what should be at this time; and I pointed their attention to a framed and glazed copy of my map of the temperatures, and rise and fall of the sun-spot numbers from 1826 to 1878, its date of publication; but with the sun-spot curve carried forward in outline, and marked with a future maximum for 1882.

C. PIAZZI SMYTH,
Astronomer Royal for Scotland

15, Royal Terrace, Edinburgh, November 18

OTHER correspondents will doubtless communicate to you their observations upon the enormous sunspot now visible, and the magnificent aurora witnessed on Friday night, the 17th inst. My object in writing is to contribute a few notes respecting the grand magnetic storm registered by the Kew magnetographs. The disturbance commenced about 8·30 p.m. on the night of Saturday, the 11th inst. Throughout the whole of Sunday, Monday, and Tuesday the magnet continued slowly oscillating through arcs of about 20′ on either side of its normal position. On Wednesday and Thursday the vibrations were frequent, but very small, partaking rather of the nature of tremors. About 10.30 a.m. on Friday the storm became violent, and from that hour up to 5.30 a.m. of Saturday, the oscillations of the magnet and the changes of force were incessant and frequently enormous, the declination needle ranging at times through almost 2°. Correspondingly large variations were also exhibited by the bifilar aad balance magnetometer. The largest deflections were between midnight and 5 a.m. of Saturday. Through that day the movements were somewhat more sluggish, and from 2 a.m. of yesterday up to 1 am. this morning (Monday) the disturbance was but trivial; it has now become again intense, and at the time of writing (noon) it is found that the needles are moving in arcs extending beyond their limits of registration. Observing the large sun-spot yesterday, it was seen that the image projected upon a screen exhibited traces of coloration, yellow and red, in parts of the penumbra; this was noticed both with the photo-heliograph and a Dollond refractor by two observers; probably it will not have escaped the notice of other correspondents. The electrograph does not show any particular disturbance of atmospheric electricity during Friday night's aurora. The tension was much higher and more variable during the dense fog of the succeeding morning. G. M. WHIPPLE

Kew Observatory, November 20

AN aurora was seen here last night. At about 5 o'clock p.m. I was told the "northern lights" were visible, and found that patches of rose-coloured clouds were forming in both the east and west, the larger and brighter portion being in the latter part of the sky. At times these were varied by a white glow, and occasionally there seemed a disposition on the part of the red patches to form into columns or beams. This, however, was never perfected, and no corona actually formed. At a little before 6 o'clock a strange and most unusual phenomenon was

seen. I happened to turn to the south, where the moon (with a very pronounced lumière cendrèe on its dark part) was nearly on the meridian, when I saw a spindle-shaped beam of glowing white light, quite unlike an auroral ray, had formed in the east. As I looked this slowly mounted from its position, rose to the zenith, and passed it, gradually crossing apparently above the moon, and then sank into the west, slowly lessening in size and brilliancy as it did so, and fading away as it reached the horizon. The peculiar long spindle shape, slow gliding motion and glowing silver light, and the marked isolation of this cloud from the other portions of the aurora made it a most remarkable object, and I do not recollect in any former aurora to have seen anything similar. About 6 o'clock the aurora gradually died away, to revive again at 9 in the shape of a white semicircle of light in a point north by west, which did not last long. Owing to moonlight, but little could be done with the spectroscope with a wide slit on the most glowing parts of the red patches only the usual green line, with a faint continuous spectrum towards the violet could be made out. At times I thought I caught traces of other lines, but with no certainty at all. The spindle-shaped beam was also examined with the spectroscope, but only gave the green line. Even in the brightest parts of the red glow, the red line could not be made out. The peculiarity of the moving beam of light was its absolute southern position. Its apparent passage across the sky was only a few degrees above the moon, then at a comparatively low altitude. J. RAND CAPRON

Guildown, Guildford, November 18

P.S.—In connection with the aurora of last week, it is interesting to notice the great disturbance of the telegraphic needles which has taken place, as I understand, all over the country. At the local post-office here all the longer lines were much affected during Friday and Saturday, sometimes to an extent interfering with ordinary messages. On Sunday morning my own time signal needle, though connected only with a short (mile and a half) wire, showed continuous disturbance; and this morning I have been watching a needle at the post-office which was working independently of any message or induced current from other wires. The effect upon the needle was not violent, but it gradually drew them over to one side or the other, where they remained a short time, and then steadily returned; and by rotating the disc containing the stop-studs, it was easy to follow the considerable deflection which took place. I saw a message sent during one of these deflections. Of course the needle was violently disturbed for the time, but returned to its deflected position afterwards. From inquiries I made, the deflections, whether to right or left, varied considerably, both as to occasions and length of time during which the needle was drawn aside, and there was no special tendency as to direction of the current. From these observations it would seem we have just now auroræ in active play around us, though from daylight and other circumstances, not always visible as on Friday night. Saturday and last night I saw no actual auroræ, but my assistant thought there was a red glow in the clouded sky of Saturday, and last night there seemed to be a white glow in the east not accounted for by the moonlight.

Since writing the above I learn that the currents have been *very* strong to-day between 1.30 and 2, and working with London intercepted. The needle generally vibrated to and fro, showing a twisted direction of current.—J. R. C.

Guildown, Guildford, November 20

A MAGNIFICENT aurora was visible here on Friday night, 17th inst., which was remarkable not only for its brillancy but for the successive changes in its character as the night advanced. At about 4.45 my attention was arrested by a splendid rosy light as from a cloud over-head, though the sun had withdrawn its light from the hill tops at 4 o'clock. It looked like a broad irregular band of cloud stretching across from west to east, but crossing south of the zenith. A little later bundles of rays of light formed in it, slowly waxing and waning; they appeared in the mass much as crystals forming in a concentrated solution, and without, so far as I could see, any parallelism or harmony of direction. Some of them were visible also in the N.E. away from the general mass. At 5.30 the lights were not so bright and by 7 o'clock nothing could be seen. At 8.30 a splendid display occurred. There was still some red light coming up from the west and stretching towards the zenith, but a low corona was displayed in the northern skies. The crown of the arch was magnetic north. Its lower border was a jagged edge upon the dark space below it, formed by broad and narrow bundles of rays of slighty yellow light all extending radially from the corona very high up over-head. These varied in intensity at different times and seemed to be travelling now east, now west; but the greatest display was at the corona. A band of light similar in character and movement appeared below the corona in the N.N.E., but was not continuous beyond or up to the middle of the arch. Up to this time there had been no rapid flashing of light from the horizon zenithwards. But at 12 o'clock the display was totally changed; waves of light travelling with tremendous velocity upwards from the horizon all round, along certain straight paths momentarily, but repeatedly illumined by them all centreing in a point about 10 degrees south of the zenith formed a magnificient spectacle. It was in plan like an umbrella over one's head, but at the point where the "ribs" should meet the "stick" there was an irregular vortex which looked as if it might be made of clouds, but was not, for it was illumined by the flashes in the same way. At 12.30 it was fading away and when the comet was rising at 3.15, I could see nothing more of it in the east and south, the only directions in which I could see.

R. H. TIDDEMAN

H.M. Geological Survey, Kirkby Stephen, Westmoreland, November 19

AURORAS of varying brilliancy were seen at York on the 12 h, 13th, 14th, 15th, 17th, and 18th (Morning of 19th) November, the 16th and evening of 18th being too cloudy for observation; the 17th giving an exhibition of exceptional brilliancy. On the 13th, 14th, and 17th a low arch was visible (5° to 15° altitude), above which a green light was very evenly diffused for 10° to 20°, then shading off in a more or less patchy manner. Streamers were rare and transient, always of the green light. At 10.15 on the 14th two appeared just west of north, broad, short, but very intense, starting from about ½° *below* the arch. At 12 on the 17th similar streamers reached 40° to 50° up, the bases being fog-hidden. Each night the display was observed soon after dusk, and was seen to last, on three occasions, till after midnight. On the 7th, at York, it seems to have begun, suddenly, at 5 precisely; the same hour is also given me from Street, Somerset, by Joseph Clark. Seen by me at Leeds from 5.15 to 6 o'clock, masses of an exquisite rose-crimson spanned the heavens, rising from near Arcturus, having Vega near the centre, and reaching down south, at times a few degrees beyond Atair, and northwards to and even beyond Polaris. Hence the illumination passed on to the east and south-east, changing imperceptibly to green near the horizon, the same colour, as on previous evenings filling the northern sky, the arch centre almost due north-north-west (magnetic north). The light was evenly spread, fading gradually into the green (which was faint) on the north, over Headingley, into a very clear sky, brightly lit by the moon on the south, and over Leeds. There were at this time no streamers, no scintillations. The bright areas expanded and contracted rapidly, but yet imperceptibly. At 5.25 a green arch suddenly shot across south of the crimson areas, very defined 1½° to 2° broad, from west-south-west to east-south-east, passing just *over* the moon. It lasted hardly a minute; the crimson cloud was then bright. Just such a "bar" "shot out" from the south-east at Street, soon after 6, "of yellowish light; it quickly increased in size and brilliancy, and went right across the heavens to the south-west," passing across in less than four minutes. It passed *south* of the moon (*i.e.* apparent altitude really the *same* as that at 5.25, Leeds being nearly 3°, 6 diameters of the moon, north of Street). My cousin continued:—"There seemed to be a dark something before the bright bar, which showed the path it would take, also a dark streak where it passed. The postmaster tells me that the telegraph-needle worked very badly this *afternoon*, turning to the right hand constantly." (The wire runs about north and south for two miles of Street at the south end). The following suggestions arise in connection with this series of auroral displays. Except the brilliant crimson cloud of the 17th, the phenomena on the various nights were very similar; *i.e.* the green glare very uniform, streamers rare, and unusually thick; the low arch over a dark, hazy, apparently cloudy space. It is said that clouds always lie near the north horizon during auroras in Great Britain. Is it certain that these in some cases may not be part of the special phenomenon? Certainly, I have always found it *look* cloudy. If such were the case 100 miles or more south of Leeds on the 17th, such "clouds" must have been where, from Leeds, the south to south-west horizon looked specially clear. Again, is the apparent shadow before an advancing ray or bar only an illusion? It certainly is a not unusual

impression. That the bars of bright light seen at Leeds and Street occupied the same relative elevation is striking. If such phenomena are produced at heights of about 50 miles, and supposing the moon's altitude were 25°, the bar seen at Leeds about 5.25 should have passed a little south of the zenith at Birmingham, a few degrees below the Pole Star near Gloucester, and 30° from the north horizon at Street. Again, do we view an actual *object* in auroral displays, and not, as the rainbow, a subjective impression only? If we do, and the display were 50 miles high, the altitude of Atair being, then, about 40°, this southern limit of the red cloud would be about 40° *north* of the zenith at Birmingham, 30° at Gloucester, under 20° at Street. If it was more extended, then either the display must exist at a much greater altitude, or it must be in some way subjective in nature. If it were 100 miles above us, or far higher than is now usually supposed, still the limit of the display would have been 10° south of the zenith at Birmingham, 10° and 35° north of it at Gloucester and Street respectively. For at Leeds, from 5.15 to 6 o'clock, the southern limit reached rarely and only a few degrees below Atair. Finally, since auroras are likely to be frequent at present, could not a regular corps of observers be organised over the United Kingdom, as has been done in the case of meteors? A few data accurately recorded for time and position at two or three localities, would settle definitely the above question, and if auroras are actual objects, the height of the display. The *lower*, well-defined edge of arches, angular height, and point of the compass of streamers, and limits of the coloured clouds might all be determined with comparative ease by star reference.

Bootham, York, November 18 J. EDMUND CLARK

P.S.—November 19. A sixth aurora last night, seen at 5.45 a.m.; the comet as well defined as a month ago, except the nucleus.

LAST evening there was a very fine display of the aurora borealis visible in York. I noticed it first at 5h. 15m. in the west: a large patch of brilliant rose-coloured light sprang from the western horizon, and extended some 30° or 40° towards the zenith, tipped by a fringe of pale yellowish-green light; so bright was the colour, as to be suggestive of an extensive conflagration in the neighbourhood. This bank of coloured light gradually extended northward in the form of an ill-defined arch, when suddenly, about 5.45 p.m., another brilliant bank of rose-coloured light sprang up due east, and was joined by the arch extending from the westerly bank of light. Above this arch were extensive streamers of greenish-yellow light extending past the constellations Taurus, Ursa Major, Cygnus, Lyra, Aquila. A second arch of greenish light subtended the eastern and south-western sky, and stretched from Taurus beyond to the south of Aquila to the horizon. The effect was very splendid, for inside this arch of light the moon was shining brilliantly. I have rarely seen so grand a display in these latitudes, and never where the colour was so brilliant. It gradually faded away, and was very feeble when I last saw it, at 7.15 p.m. I watched the ever-changing scene for about an hour. During the month there have been several large spots on the sun, which I have observed each day that it was possible to make an observation, with a 4¼-inch refractor by Cooke. H. CLIFFORD GILL

Bootham, York, November 18

P.S.—I see in this morning's paper that the telegraphs have been seriously affected by the magnetic storm, not only in England, but on the Continent.

A FINE aurora was visible from here last evening. When my attention was first called to it a few minutes after 5, the whole northern half of the heavens was suffused with a ruddy glow, as though there was a fire in the neighbourhood. Without paying further attention to its general appearance to the eye, I at once proceeded to examine it with a spectroscope, and found a distinct and sometimes quite bright green band. By the aid of a micrometer scale attached to the spectroscope I took about half a dozen readings of the position of the green band, and successively compared its position with that of one of the bands in the spectrum of the flame at the base of a Bunsen burner. My readings were necessarily taken hastily, but they uniformly agreed in being nearly coincident with, but slightly more refrangible than, the band of wave-length 5581, in the flame of the Bunsen burner. The green band was certainly nearer the hydrocarbon band of wave-length 5581, than to the next one in the same group, on the more refrangible side of wave-length 5542, and so agrees well with Ångström's measurement 5567. The ruddy colour varied in intensity and position for about an hour, and soon after six disappeared. I found the green band was easily seen by directing the spectroscope to parts of the sky, on the northern side, even when without it, one would not have noticed any unusual appearance. I also thought I saw indications of blue or indigo bands, but I could not identify any with certainty. Later on in the evening, from about half-past seven till a quarter to nine, when the sky was much clearer and the stars and moon were bright, now and then the aurora was very brilliant; but the light was green except just once towards the last, when at about 60° or 70° from the horizon, the ruddy glow appeared for a few moments. About half-past eight the sky from the horizon to about 30° was suddenly so brightly green, that had I not known of the aurora, I should have imagined the appearance was due to green fire. About this time fine green streamers frequently shot upwards to a great height. Unfortunately during the latter part of the display I had no spectroscope with me to make further observations.

HENRY ROBINSON

University Chemical Laboratory, Cambridge, November 18

MAY I ask space for the record of an observation made during the fine auroral display of Friday evening, which if compared with similar observations made at other stations may serve to determine with considerable accuracy the height above the earth at which the display took place? For the sake of better observation of the aurora I had gone up to the Durdham Downs by which Clifton is bordered to the north, and from which one has an almost uninterrupted horizon in all directions. The sky was every where very clear, even close to the horizon, and the auroral arch was very conspicuous in the north; its summit lying between the stars Delta and Epsilon in the Great Bear. At 3 minutes past six o'clock a brilliant elongated patch of greenish white light appeared suddenly in the east, below Saturn and to the right of it, the centre of the patch being about 8 degrees from Saturn on a line drawn through the planet at an angle of 45° with the horizon. When first seen the patch was about 6 degrees in length and half a degree in width and the ends had a rough splintered appearance. It rapidly increased in length and less rapidly in thickness, till it closely resembled in general appearance the great Nebula in Andromeda as seen with a good telescope, and the length of the conspicuously luminous portion was apparently about as great as the distance between the stars Alpha Pegasi and Delta Andromedae, i.e., about 27 degrees. The breadth at the centre seemed about equal to twice the moon's diameter. I expected it to lengthen out into an arch across the sky like other fainter ones, which were visible at the time between it and the arch to which I have already referred, but instead of doing so the patch began to shift rapidly across the sky end foremost, as if ascending the eastern slope of the arch which I had expected it to form, then after reaching the summit where its length was horizontal, it rapidly descended the western slope and disappeared near the horizon, passing close under the moon at a distance which I estimated immediately afterwards as rather less than three times the moon's diameter, (measuring from the centre of the luminosity to the moon's lower cusp). The duration of the phenomenon was hardly a minute and its brilliance far exceeded that of any other portion of the display. My colleague Mr. Jupp, who observed a portion of the phenomenon from another place estimated the distance from the moon's cusp as four moon's diameters. The width at the centre we agree in estimating at two moon's diameters. It is not, I believe, often that any portion of an auroral display is so easily distinguished from the rest and localized as was this.

A. M. WORTHINGTON

Clifton College, Bristol, November 19

AN auroral display of unusual magnificence, and lasting upwards of four hours, was observed here last evening. At about 5h. the northern quarter of the sky from the horizon to the zenith, was covered with a delicate crimson glow of surpassing beauty, which included evanescent streamers of a deeper tint. These were succeeded by others of a creamy-white colour, which were more persistent, but did not attain so great an altitude. At 6h. 5m., when the display was at its maximum, a remarkable phenomenon was seen—a bright greenish-white band of a lenticular form, about 20° in length and 5° broad (its axis being parallel to the horizon in the south), passed from the south-east to the south-west horizon, attaining an altitude, when due south, of about 20°. It occupied about six seconds in passing from horizon to horizon, and its brightness seemed to be but slightly

affected by the light of the moon, which was shining in the south, and below which it moved. The light of the rosy streamers, when first examined at 5h. 15m. with a small direct-vision spectroscope, gave two very distinct bright lines, one in the red (presumably near C), and the other in the green. There was a faint continuous spectrum towards the more refrangible end, but no traces of other lines. Afterwards, when the display was at its best, only the bright line in the green was observed, but it was much more brilliant than before, and could be traced in every part of the sky except in the south. It was weak in the zenith, but towards the north horizon it stood out with extraordinary distinctness, and was especially strong in the lenticular band seen at 6h. 5m. This line could be easily seen in the northern sky when all signs of the aurora had apparently passed away. At 7h. 45m. the glow assumed the form of a well-defined arch, extending from the north-east to the north-west horizon, and reaching an altitude of about 30°. It remained more or less distinct till 8h. 30m., after which time the light gradually diminished, till at 9h. the sky assumed its usual appearance. During the greater portion of the evening the sky was perfectly cloudless. This display was certainly finer than that seen on October 25, 1870, and though fewer bright lines were observed in its spectrum than on that occasion, the two which were seen were far better defined, and much more brilliant.

Kempston, Bedford, November 18 THOS. GWYN ELGER

ON last Friday afternoon at 5.15 I observed in the north a magnificent auroral display. The moonlight mixed with the fading twilight was of course unfavourable to the brilliancy of such a phenomenon: notwithstanding which the auroral glare—suggestive of rose-coloured clouds, alternately intensifying and fading—was a very remarkable spectacle. A sharp frost supervened. C. ROSE INGLEBY

Valentines, Ilford, November 20

A BRILLIANT auroral display was observed here last night. I first noticed the pale auroral arc at 5h. 30m., the top of the arc at that time being just below Merak and Phecta in Ursa Major. At 5h. 40m. red streamers were seen in the north-west and shortly afterwards in the north-east, and then at intervals pale streamers were observed all along the arc. For about five minutes a double arc was visible, a band of dark sky intervening between the two, which combined to form one broad arc, and remained so to the end of the display. At 6h. there was a very apparent waning of the streamers, and at 6h. 30m. they had entirely disappeared. The auroral-arc remained until about 9h. 30m. With a Browning's miniature spectroscope I saw the green line very distinctly, while the red streamers appeared to show a very faint red band. Perhaps it is worthy of notice that the sky, which to the naked eye was dark, showed on examination the characteristic spectrum. C. H. ROMANES

Worthing, November 18

ANOTHER splendid display of aurora was seen here last evening, commencing at 5.10 with a column of rose-coloured light in the north-west, which, rapidly becoming diffused, spread upwards to the zenith, a similar glow being visible in the east. In the northern horizon a double arch of white light extended from beyond Capella to the north-west, from time to time shifting its position and increasing in altitude till the two arches had melted into one, from which rosy streamers went upwards. But lovelier and more wonderful even than this display was a shaft of intense white light, which, just as the chimes of the old church clock were dying away at 6, passed rapidly like a flying arch across the heavens at an altitude of about 30 degrees, and vanished below the southern horizon. After 6.45 the rosy tints had gradually subsided, and at 8 a pale light in the north was all that remained, but I have been told that at 12 and 3 a.m. coloured streamers were again visible. E. BROWN

Further Barton, Cirencester, November 18

THE fine display of the aurora borealis was seen here Friday evening from a little before 6 o'clock. The sky was clear, and the moon, seven days old, was well up. The chief features of the aurora were the two patches of deep pink light, one in the west, in the constellation Hercules, and the other in the east, between Capella and the Pleiades; connecting these two patches was an arc of lighter tint passing between the two Bears. At 6.10 a beam extended from this arc to the left of Cassiopea, towards the zenith; at 6.20 this had disappeared, and another very distinct lay through the body of Ursa Minor, right to the zenith, more over the concentration, as it were, of pink light near Perseus in the east had disappeared, and the light ended at Capella. At 6.40 Capella and β Aurigæ were clear of it. The patch in the west did not disappear, but grew fainter. At 6.50, while watching the display, a magnificent meteor fell slowly from the body of the Little to the tail of the Big Bear, leaving a short red tail there. At 7 the pink tint of the auroral arc had almost disappeared, giving place to one of phosphorescent light, extending from near where Jupiter was rising in the east, through the body of Ursa Major, to below Hercules in the west. This grew fainter, till at 7.30 it was scarcely noticeable. But at a little before 11 p.m. there extended a narrower and brighter line of phosphorescent light, slightly arched from 10° to 15° above the horizon. From this, at 11.20, the streamers began to radiate towards the zenith, alternately forming and disappearing, some stretching to the zenith, some only half way. At 11.45 repeated flashes of light swept up along the streamers, happily likened by one of your correspondents to the flapping of a flag in a breeze. At times a long streamer would appear broken off from the arc of light, and fade away. At 12 the streamers had vanished, leaving only the phosphorescent light near the horizon, though now and then a streamer would form. At 12.30 a pink tint appeared in the north-east, and more streamers formed till 12.45, when the light began gradually to fade away, till at 1 a.m. nothing of the display was to be seen. The day had been overcast, wind north, but towards evening it had cleared; during the night it was freezing; the barometer, at 29·6, was rising; the moon had set at 11 p.m., and the sky, free from clouds, was all that could be desired in which to witness this splendid display of northern lights. FRANK STAPLETON

Oxford, November 19

I BEG to hand you an account of the extraordinary apparition of Friday evening last, November 17, as seen at Clevedon, during a brilliant rose-coloured aurora. The time was about 6.15 p.m. There rose suddenly, through the haze in the east, a beam of light, at an angle of some 60° with the horizon. It crossed the cloudless sky rather below the moon, and sank in the west, occupying about eighty seconds in the transit. The trajectory was much flatter than that of the stars, &c., but was at right angles to the meridian, which was crossed at an approximate altitude of 22°. I estimated the length of the beam at 35°, and the breadth at the middle to be 3°; from whence it tapered gadually to a point at each end. The colour was uniform throughout—a very pale yellowish white, without coruscation or change; and there was no indication of a trail, or of any sort of atmospheric disturbance. The impression conveyed to me was that the beam was stationary in space, and comparatively near, and that we were being carried past it by the rotation of the earth. The major axis lay on the apparent path, but in the earlier and latter parts of the course it was much foreshortened; and as the western horizon was approached, a formation of a similar character, perhaps 7° northward, and running on a parallel track, was visible for several seconds before both were lost in the trees. This second object was also noticed by others whose view westward was less interrupted. I watched the whole evening without seeing any tendency to a repetition of the phenomenon. The sky remained cloudless, with the temperature at the freezing point. There was no wind; and the aurora, which continued off and on until past eleven o'clock, at no time threw out any considerable rays or streamers. The strange visitor caused great commotion among the many who were out of doors looking at the aurora, some of them fearing that the supposed runaway comet was coming into collision with the moon, then half an hour past the meridian, and relieved when it passed below it. I had, however, a much better corroboration of the altitude above given, a careful observer who was with me placing a rod in the direction of the supposed meridian passage. The angle closely agreed with my estimate. We now require to know at what place south of this the beam was seen to cross the moon's disc, for computing the actual distance and position. Many of your readers will not have failed to note that a splendid aurora again coincides with rapid and striking changes in the configuration of a gigantic spot in the sun. With a 3¾-inch achromatic, I was able on the same afternoon to observe those changes from hour to hour, on a scale I never before witnessed.

STEPHEN H. SAXBY

East Clevedon Vicarage, Somerset, November 20

WHILE watching the grand display of aurora on Friday night from our roof, at about 6h. 7m., my wife and I saw a strange gleam of light rising above a bank of cloud on the eastern

horizon, nearly vertically below the Pleiades, like the gleam of another moon rising in a haze. It grew out slowly, as we watched it, into a strong beam of white light slanting towards the south, and we stood in wonderment as it lengthened out making straight towards the moon. Presently its tail was disengaged from the cloud, and it stole through the sky like a long luminous nebulous "cigar-ship" exactly across the moon, and away down into the west, sinking as slowly as it had risen. In the middle of its course it was, as well as I could estimate, about 40° in length and about 5° in width. The ends were, I think, slightly tapering and hazy; the sides pretty well defined. I did not notice if the moon's crescent was at all blurred during the passage; my wife is under the impression that it was. The time occupied from first appearance to final disappearance was about one minute. You will probably receive many accounts of this strange apparition. It will be interesting to know the position relative to the moon in which it was seen by different observers. Was it clear of the earth's atmosphere or not?

Woodbridge, November 19 HUBERT AIRY

YOU will no doubt have abundant accounts of Friday's aurora. I have received the following from a correspondent in North Devon, dated Friday 6.5 p.m. . . . . "As we watched, a brilliant comet (apparently) appeared near Saturn" [which must have been low down, a little N. of E.] "and in a direct line between Saturn and the moon" [at that hour nearly in the meridan and 28° in altitude]. "It was about twice as big as the comet." [Here follows a sketch, which the above 'asides' render it unnecessary to copy.] "It travelled stern foremost towards the moon, and was in sight a full minute. As it disappeared it seemed to leave a black cloud of its own shape which also disappeared in a few seconds (an optical delusion perhaps)." It does not appear to have occurred to the writer that this appearance was itself auroral. J. HERSCHEL

30, Sackville Street, November 18

I AM unable to explain the following occurrence which I observed this evening at 6h. 5m. p.m. It appeared to be a well-defined spindle-shaped body of a cloudy consistency, having a brilliant white colour. It subtended a visual angle of about 20 degrees. I first observed it due east, and immediately noticed that it was moving with very great rapidity, as in less than one minute it had disappeared below the horizon in the south-south-west. There was a rosy aurora visible at the time in the north, which, however, was in no way connected with it. The atmosphere was perfectly clear in that part of the heavens traversed by the phenomenon, though in other parts of the sky there were a few stationary clouds visible. A friend who was with me at the time will corroborate all my statements. As I am utterly at a loss to explain this phenomenon, I would be much obliged for any suggestions or explanations from your readers. A. S. P.

Cambridge, November 17

I THOUGHT that many of the readers of NATURE would be interested in a curious phenomenon which appeared during the beautiful coloured aurora on the evening of the 17th. I was watching it from a position commanding a large view of the sky, when, as I was looking south-east, a long patch of white light appeared about 10° above the horizon. This was commonplace at first, but then it quickly developed into a long, gleaming, and well-defined streak. It looked very like two brilliant comets joined end to end by the tip of the tail. This took about a minute to form, and when complete, it started off in the direction of its length in a curved path which gradually rose above the horizon until it culminated at an elevation of 30° on the magnetic meridian; after which the west end inclined downwards, and it continued its journey in inverse order to the south-west, keeping its symmetry and shape like a rigid body all the way, until it reached a position in the south-west, corresponding to its place when forming, and here it halted and dissolved away. The band of light was about 30° long, and beautifully curved along its path. It took about three-quarters of a minute in its transit, which occurred at 6 p.m. It was an extraordinary sight, and I hope some one else has observed it. During the phenomenon, the aurora in the north-east and north-west (magnetic) was very fine, showing rich red and apple-green streamers; these were very steady all the time. I have made a sketch of the band of light, as nearly as I can remember it. It was very bright, even when under the moon. I think this sketch gives a good idea of it, and I inclose it in case it be wanted. The southern sky was quite *clear* at the time. H. D. TAYLOR

Haworth, York, November 19

ON Friday, November 17, we had a great auroral display at 4.30 before sunset, and continuing till 5.30, the heavens were aglow with auroral light of a rosy tint, changing occasionally into silver grey. A haze overspread the sky until 10 o'clock, from which hour till 2 a.m. Saturday the sky was brilliant with aurora. The streams of light culminated near the zenith, and at midnight the magnetic storm appeared to reach its maximum. The magnetic disturbance must have been great for several hours, as nearly all telegraphic operations had to be suspended.

Newcastle-on-Tyne, November 19 T. P. BARKAS

ABOUT 5.20 p.m. on Friday last I witnessed the most remarkable auroral display I have ever seen, and as it only lasted a few minutes, may have escaped the attention of many. My attention was first attracted by a broad crimson band stretching quite across the sky, and almost coinciding with the Milky Way. Some of the bright stars could be seen through it, but gradually it became opaque at the zenith and appeared to concentrate around an opening, forming a complete corona, out of which the rays seemed to boil over and dart out in every direction, but chiefly northwards. It was a most weird-looking sight, and reminded me of "The Glory," as shown in pictures of Saints. Overhead it rapidly faded away, but bright streamers were visible up till 9 p.m., when a thick fog came on.

W. MAKEIG JONES

Wath-on-Dearne, Rotherham, November 20

IN connection with the recent appearance of the aurora borealis, a remarkably large sun-spot was visible to-day, occupying a position in about the middle of the disc. The spot might be called an aggregation of spots, from its area. Several minor spots were also visible, which were discrete.

Rugby, November 19 GEORGE RAYLEIGH VICARS

THERE was visible here on Friday, the 17th, between 5.30 and 6 p.m., a display of aurora. My attention was called to it by the ruddiness of the sky towards the north, and I continued watching it till near 6 o'clock. The sky was clouded with cumulo stratus, and the stars only visible here and there through the intervals of these clouds. The centre of the ruddiness or glow appeared to be over Auriga, the most brilliant star of which group was just visible. It extended to the east so as to cover Gemini, and about an equal distance west. It shifted and varied very rapidly, maintaining its ruddy colour, and this very rapidity of shift assured me that it was really an aurora. After 6 o'clock p.m. the clouds nearly completely covered the sky, and neither at 7 o'clock nor at 8 o'clock did I see any further sign of the appearance. I could not distinguish any beams whatever. J. P. O'REILLY

Royal College of Science for Ireland, Stephen's Green, Dublin, November 18

P.S.—I was informed that on the evening of Thursday a similar display had been noticed.

AT about 6.5 p.m. on Friday a bright, white, cloud-like object, in shape like a fish-torpedo or a weaver's shuttle, was observed to cross the heavens from east to west. Its length was roughly about 30°, and its breadth about 4°. I noted it first shoot up, like a strong electric ray in a fog, a little south of Aldebaran, and slowly, as it were, slide along at the same N.P.D. across the face of the moon (which was shining brightly at the time), and disappear in the west under Atair. Its surface had a mottled appearance; its colour *white;* its motion was slow, being visible, from horizon to horizon, upwards of 50 seconds; its brightness was strong, and did not seem to fade, even when crossing the moon, and it seemed preceded and followed by a strong black margin; though this I suppose was the effect of contrast and subjective only. The aurora was noted here from 4.30 on Friday till about 5 a.m. on Saturday.

JOHN L. DOBSON

Beaumont College, Old Windsor, November 21

THE CHLOROPHYLL CORPUSCLES OF HYDRA

IN the last number of the *Zeitschrift fur wiss. Zoologie* is an article by Mr. Hamann, assistant in the Zoological Institute of Jena, on the "Origin and Development of the Green Cells in Hydra." I cannot allow

this article to pass in silence, and think that the pages of NATURE, in which already there has appeared a good deal relative to the supposed infection of animal tissues by green unicellular Algæ, offer the most fitting place in which to lodge a protest against the reception of Mr. Hamann's conclusions as reasonable.

In the first place, Mr. Hamann has not made himself acquainted with previous writings on this subject. He briefly states that "R. Lankester disputes" the algal nature of the green corpuscles suggested by Brandt, and the existence of a cell-nucleus in them, and refers the reader to a paper by me on "Symbiosis of Animals with Plants," which has no existence. Mr. Hamann has not read the article to which he refers, which appeared in the *Quart. Journ. Microsc. Sci.* April, 1882, and was entitled "On the Chlorophyll Corpuscles and Amyloid Deposits of Spongilla and Hydra." Mr. Hamann has accordingly failed altogether to take up the points of importance in the discussion. These seem to me to stand somewhat as follows: It had already been urged (1) that the green corpuscles of Hydra multiply by fission; (2) that they possess each one or more cell-nuclei; (3) that they possess a cell-wall comparable to the cellulose wall of a unicellular Alga; (4) that starch is developed within them even after their removal from the living Hydra. It had been inferred (by Semper, and later by Brandt) that consequently these corpuscles must be considered as unicellular Algæ.

To these considerations I had replied in the article above named, by describing carefully the nature of the "fragmentation," or division of the chlorophyll corpuscles of both Hydra and Spongilla. I cited the notorious fact with regard to the chlorophyll corpuscles of plants, namely, that they multiply by fission. I showed further, by description and figures, that *there is not any structure present in the chlorophyll corpuscles of either Hydra or Spongilla which is comparable to a cell-nucleus or to a cell-wall*, and that the ascribing of such parts to the chlorophyll corpuscles of Hydra is *totally erroneous*.

I further insisted that we are not acquainted with any unicellular Algæ at all resembling the chlorophyll corpuscles of Hydra, whilst the chlorophyll corpuscles of plants closely resemble them,—and finally I pointed out that there is as much reason to regard the chlorophyll corpuscles in the leaf of a buttercup as unicellular Algæ as there is so to regard those of *Hydra viridis*.

Mr. Hamann does not in any way deal with these observations, but naïvely remarks, after describing his observation of the already-known multiplication by division of the chlorophyll corpuscles of Hydra, "after these observations the nature of our green corpuscles as Algæ seems to me to be firmly established." This seeming can only arise from the fact that Mr. Hamann is not acquainted with the characteristics either of Algæ or of the chlorophyll corpuscles of plants.

A simple assertion that a nucleus and a cell-wall are present in the chlorophyll corpuscles of Hydra is all that Mr. Hamann gives us on this head; although his paper is illustrated by a plate, no nucleus and no cell-wall are figured by him. Were he able to adduce good evidence of the existence of either of these structures, the view which he has advocated would be materially advanced. But this he is unable to do, because such structures do not exist.

Mr. Hamann offers some observations on the occurrence of chlorophyll-corpuscles in the egg-cell of Hydra which lead him to assume that these corpuscles enter the egg-cell by "wandering" from the endoderm-cells. The figures and statements which he makes do not, in my opinion, tend necessarily to that conclusion.

Lastly, I would point out that the exceedingly variable form of the chlorophyll-corpuscles of Hydra and Spongilla which I have illustrated by figures in my memoir above cited, is not noticed by Mr. Hamann. This variability is quite inconsistent with the view that they are parasitic Algæ. So also is the fact that these corpuscles are represented by colourless corpuscles in the colourless varieties of Spongilla and Hydra which turn green when treated with sulphuric acid.

It should be distinctly borne in mind that it is by no means necessary, supposing that the green corpuscles of Hydra are parasitic Algæ, that a nucleus should be present in them, nor indeed a well defined cell wall. But when the presence of such structures is asserted as evidence that these corpuscles are different in nature from the otherwise closely similar corpuscles formed in the protoplasm of green plants, the question of the actual presence or absence of the nucleus and cell-wall becomes important, and must be definitely decided upon thorough histological evidence.

So far it appears to me, as I have previously maintained, that there is no more and no less evidence for considering the green corpuscles of *Hydra viridis* as parasitic Algæ, than there is for taking a similar view with regard to the green corpuscles in the leaf of an ordinary green plant.

E. RAY LANKESTER

NOTES

WE regret to notice that in Tuesday's papers the death of Prof. Henry Draper of New York is telegraphed. We hope to be able to refer to his work in an early issue.

THE Council of the British Association have nominated Mr. A. G. Vernon Harcourt, M.A., F.R.S., to the office of General Secretary of the Association, in the room of the late Prof. F. M. Balfour.

MARINO PALMIERI, whose death we announced a fortnight ago, must not be confounded with his father, Luigi, the eminent director of the Vesuvius Observatory, who we are glad to be able to say is alive and well.

THE death is announced, on November 11, of Dr. Franz Ritter von Kobell, Professor of Mineralogy and keeper of the mineralogical State collections at Munich, well known through his numerous mineralogical publications. He died at the age of seventy-nine years.

M. JANSSEN has been sent to Oran to observe the transit of Venus from a physical point of view.

WE have received a circular in reference to the visit of the British Association in Montreal, containing the results of the recent meeting in that city, to which we have already referred. It is evident that the Canadians are determined to do all in their power to make the visit of the Association a success. "The city of Montreal, which has a population of about 150,000 souls has," the circular states, "twice entertained the American Association for the Advancement of Science; for the second time in August, 1882, when an attendance of more than 900 members and Associates was registered, and the Association, with its nine sections, found ample accommodation in the buildings of McGill University. The ordinary summer-passage is made in eight or nine days from Liverpool to Quebec, which city is connected with Montreal by two lines of rail, making the journey in six hours, and by river-steamers. From Montreal to Ottawa, the capital of the Dominion, is four hours by rail; from Montreal to Toronto, thirteen hours; and to Niagara Falls, sixteen hours by rail. Montreal is in direct connection with Boston by two lines of rail, by which the journey is made in ten hours. There are also two lines connecting Montreal with New York city in thirteen hours, and one with New Haven in sixteen hours. It is expected that the American Association for the Advancement of Science will hold its meeting in 1884 in New Haven, or some other eastern city of the United States, at such a time

as may permit the attendance of members of the British Association, either before or after their gathering at Montreal. We have assurances that the Government of the Dominion of Canada will make a liberal grant of money to defray the expenses of members of the British Association in crossing the ocean, and that the various railroad and steamboat lines in Canada and in the United States will offer most liberal arrangements to our guests. The Grand Trunk Railway will arrange for an excursion of members of the Association to the Great Lakes and Chicago, while the Canadian Pacific Railroad will give an excursion to the provinces of the North-West, as far as the Rocky Mountains. It is believed that the British Association may count upon a large attendance of local members and associates both from the provinces of the Dominion and the United States. In any case, the Finance Committee are prepared to guarantee that the revenue from this source shall not fall below that ordinarily received by the Association. Members of the British Association in coming to Canada may be assured of a most cordial welcome and generous hospitality, not only from the citizens of Montreal, where every facility will be furnished for their meeting, but from the people throughout the country. It is hoped by the Invitation Committee that these assurances, and the above statement of the advantages and facilities offered them, may secure a large attendance of the members of the British Association at Montreal in 1884."

IN the sitting of the Academy of Sciences of November 20, M. Dumas read an *arrêté* from the Minister of Public Instruction, regulating the competition for the Volta Prize, which will be delivered in 1887. It is expressly decreed that the competition be open to every nation. A report will be made by the Commission *ad hoc*, and published *in extenso* in the *Journal Officiel*.

AT the meeting of the Paris Academy on Monday M. Dumas stated that at the very beginning of its work, the Academical Commission for the destruction of the Phylloxera proposed to arrange for the immediate destruction by fire of each plant proved to be infested. Objections were made to this scheme grounded on the state of French legislation on rural property, and the Academical Commission desisted. M. Dumas states that he has in hand an official report from Switzerland establishing the soundness of the views taken by the Academy on this important question. The cantons of Geneva, Vaud, and Lucerne having resorted to the destroying process, all the vines, of which the value exceeds 40,000,000*l*., had been saved at the expense of a few thousand pounds. A special tax had been imposed on the proprietors of vines for compensation to the owners of the destroyed plants.

A FIRST application has been made of the resolutions of the last Congress of Electricians proposing that regular observations should be made on earth currents during magnetical perturbation. The perturbations of November 17 have been accompanied in France by strong earth currents principally in the south-north direction. We may state, moreover, that others were observed on November 20, exhibiting a very great force.

LARGE electrical disturbances have been observed in Sweden and Norway during last week. On Friday last all telegraphic communication became for a time suspended, and at Stockholm and Jönköping central telegraph stations several instruments were destroyed. In Norway the electric storm was accompanied by thunder, a phenomenon almost unknown at this time of the year.

A LARGE and enthusiastic meeting was held on Saturday evening last, in Trinity College, Prof. Moseley, F.R.S., in the chair, when the following resolution was carried unanimously:—"That it is desirable that a society should be formed for the purpose of bringing together the Undergraduates and Bachelors of Arts of the University, who are engaged in the study of Natural Science, for the friendly discussion of scientific and other topics." The officers and members of the new club were elected, Mr. Bond, B.A., being elected president, and the first meeting will be held in the course of next week.

THE Rev. T. W. Webb writes to the *Times* as follows on the comet:—"As it must be universally admitted that the magnificent comet now receding from our sight is the most interesting, in a popular as well as scientific point of view, of any that have appeared for many years, will you allow me to add the record of a very remarkable phenomenon to the somewhat scanty details respecting its aspect which have as yet been laid before the public? In an extremely valuable letter received by me this morning from a very able and careful observer, Mr. J. T. Stevenson, of Auckland, it is stated that on October 6 and 10 an 'anomalous' tail was feebly but distinctly visible, pointing towards the sun. Your astronomical readers will remember that a similar 'glowing wake' attended the returning course of Newton's great comet in 1680, distinguished, like the present, by its close approach to the surface of the sun, and a few more cases might be cited. It is, however, of such infrequent occurrence, that another instance forms a valuable addition to our stock of information as to these mysterious bodies. I ought to mention that Mr. Stevenson's letter was despatched immediately after his last observation, so that we may hope that, with a climate and position of the comet giving him great advantage over northern astronomers, he may have been able to trace this singular appendage on subsequent occasions."

THE German Society for the Prevention of the Pollution of Rivers, the Soil, and the Atmosphere, held their fifth annual meeting at Brunswick on October 19 and 20 last, under the presidency of Prof. Reclam (Leipzig). The number of papers read was considerable and the attendance very large. Among the speakers were Burgomaster Rittmeyer (Brunswick), Prof. Müller (Berlin), Dr. Blasius (Brunswick), Dr. Engler (Stuttgart), Herr Knauff (Berlin), Dr. Gerson (Hamburg), Dr. Petri (Berlin), and Dr. Beckurts (Brunswick).

WE have received from Mr. J. P. Walker, C.E., Stirling, a communication on the Forth Bridge, but we can hardly venture to insert in our columns the descriptions of Mr. Walker's and other plans for such a bridge. The peculiarities of the plan drawn by Messrs. Fowler (chief engineer) and Baker, and the circumstance that it had been accepted by Commissions of Parliament and of the Board of Trade, gave it great claims on our attention, which can scarcely be recognised as applying to any other proposal.

THE Glasgow *Evening Times* has the credit of being the first daily paper, so far as we know, to introduce into its pages star-maps showing the aspect of the heavens at stated times. On November 11 it started with four such maps, and the series will be continued. There are full instructions as to the meaning and use of the maps, and we have no doubt they will be the means of leading many people to form a practical acquaintance with astronomy.

THE first number of the *American Journal of Forestry* bearing date October last has just reached us. It is edited by Franklin B. Hough, Ph.D., Chief of Forestry Division U.S. Department of Agriculture, and has as contributors an array of well known names connected with forestry matters in America. The journal in size and shape corresponds with the *Journal of Forestry* published in this country, and edited by Mr. F. G. Heath. It is not, however, so tastefully got up, though the printing and the character of the art cles are very similar. The contents of the number before us, for instance, are, after the Editorial "Announcement," a paper on "Forestry in Michigan," one on "Larch Wood," one on the "Forestry of the Future," by the Editor, on "Forest Fires," on the "American Forest Congress," and the usual "Miscellany." The forests in America are so

extensive and there is so much connected with them that belongs legitimately to the subject of forestry that we have no doubt the journal will meet with a wide circulation.

THE Annual Report of the Public Gardens and Plantations in Jamaica for the year ending September 30, 1881, has just reached us, and from it we gain some idea of the work that is being carried on in the island under Mr. Morris's care in the dissemination of useful plants. It is satisfactory to find that of late years a considerable amount of attention has been directed to the extended cultivation of economic plants in all our Colonies, a branch of culture that must in the end prove of more lasting value to mankind generally than the growth of any mere horticultural novelty or scientific rarity. Mr. Morris's Report from beginning to end is a record of what can be done by a single establishment in the introduction of new plants and their distribution amongst planters in the several colonies. As an illustration of this Mr. Morris says "there is much activity displayed even by the poorest peasants in obtaining and cultivating new and important plants, and I cannot but hope, that before many years have elapsed this activity will result in the greater prosperity and wealth of the island, and in placing it in the first rank as exporter of fruit and raw materials to the markets of England and America." Regarding Jamaica in particular, Mr. Morris says: "It is evident that Jamaica must depend for its prosperity and success almost entirely on the resources and products of an agricultural character. We have no large stores of timber, we have no minerals, we have no manufacturing industries, and we cannot hope to struggle successfully with other countries in the more advanced arts and sciences. We nevertheless possess a rich and productive soil, a salubrious climate, abundant springs, and a vast extent of uncleared mountain land; and it is mainly on the due utilisation of these valuable natural resources that our prosperity must ultimately depend. Under these circumstances the chief aim of the Department has been directed towards bringing into notice the nature and character of such resources, and to fostering and promoting any well directed efforts for their utilisation. The position and prospects of several new industries, such as Liberian coffee, cacao, tobacco, oranges, mangoes, pine-apples, spices, india-rubbers, fibre-yielding plants, &c., are carefully noticed with this view, and the success which has already attended these comparatively recent efforts would indicate that capital and energy are alone wanting to place the island in an important position as to the source of most tropical productions." Naturally a good deal of attention has been paid to cinchona cultivation, and a large number of plants of the best varieties have been raised, seeds and plants having been distributed to private plantations, and sold in considerable quantities during the year. The cultivation of the jalap plant promises also to become one of considerable importance in Jamaica.

TO give an idea of the dairy-industry in France, M. Hervé Mangon recently stated (at an agricultural gathering) that the milk produced in the country would, if collected, form a stream about 1 metre in width and 33 centimetres in depth (say 3 feet 4 inches and 1 foot 1 inch), flowing night and day all the year, with a mean velocity of a metre per second. Young animals drink a part of this enormous volume of milk, man takes a good part of it, and the rest is transformed into cheese and butter. No branch of agricultural industry has so progressed during the last fifty years as the making of butter. In 1833 France bought abroad 1,200,000 kgr. of butter, and sold to foreigners only 1,100,000 kgr. She now exports 34 to 35 million kgr. of butter annually, and receives in return from abroad (especially from England) a sum of more than 100 million francs. La Manche alone furnishes more than one-third of the total exportation.

A VALUABLE investigation of the origin of metalliferous lodes, by Prof. Sandberger, of Würzburg, has recently been published at Wiesbaden. The various theories are discussed, more especially those of ascension, and of lateral secretion or levigation. Till 1873 the author was a partisan of the former, but he was led to make a chemical study of the gangues and lodes in the Black Forest, and by 1877 he had got so far as to obtain proof, for the greater part of the mining districts in Germany, that the lodes had been formed by levigation of the encasing rock. The second part of the work is elevated to a special study of the environs of Wild Schapbach in the Black Forest, as illustrating the theory of levigation. (An outline of these researches appears in *Archives des Sciences*, October 15.)

AN improved feed-water heater and purifier has been recently described to the Franklin Institute by Mr. George Strong. It is said to effect a saving in coal of 22 per cent., and an increase of evaporation of 1·09 pounds of water per pound of coal. Considering that all substances likely to give trouble by deposition would be precipitated at about 250° F., he obtains this in the heater by action of exhaust steam, aided by a coil of live steam from the boiler. He also uses a filter formed of wood-charcoal, and-bone black firmly held between two perforated plates. (Further details will be found in the *Journal* of the Institute for November.)

IT appears from the *Shen-pao*, a Chinese newspaper published at Shanghai, that the Chinese are taking practical steps in the matter of foreign education. A school for the education of Chinese boys in foreign matters has been established in the Pun-yen district of Canton, and it has already fifty scholars. So far the school has been a success, and to meet the requirements of the scholars it is proposed at the next Chinese New Year to solicit subscriptions to enlarge the school premises. The teachers are Chinese well versed in English, and the school bids fair to be followed by many others of a similar kind. A satisfactory circumstance about it is that the institution has been founded by the people themselves with official countenance or assistance, and that Chinese gentlemen competent to teach these schools are now to be found. European teachers and professors are of course absolutely necessary for a time; but their want of knowledge or imperfect knowledge of the language of the country must cause them to be make-shifts at the best.

UNDER the title of "Les Grandes Ascensions Maritimes." M. W. de Fonvielle has published (Paris, Ghio) a *brochure* giving an account of several balloon ascents over the ocean, including some, such as the late Mr. Powell's, which have come to grief by being driven into the sea.

THE Tenth Annual Report of the Lambeth Field Club speaks hopefully of its condition; it seems to be doing good work.

THE public dinner in celebration of the 100th anniversary of the first experiment at Annonay by Joseph Mongolfier was given on Saturday at Paris by the Académie d'Aérostation Météorologique. Three members of the Mongolfier family were present. Several speeches were given, and a general committee was appointed to organise a national celebration on June 5, 1883, the anniversary of the first public experiment at Annonay before the États Généraux du Forez.

THE *Journal Officiel* states that the director of the Compagnie du Cap has given to the Paris Museum of Natural History a diamond weighing 4½ carats, enveloped in its native rock. It is supposed that this generous donation will determine the public authorities to send to the museum a part of the jewels of the French Crown, which are now kept in the Bank. The question of their sale has not yet been settled, in spite of several parliamentary and extra-parliamentary reports.

NEWS from Perugia now states that the earthquake began on October 28 at 6 p.m., and with short interruptions lasted until

October 29 at midnight. A real panic is reigning among the population of Cascia. The extent of the zone of the phenomena cannot yet be ascertained, but it seems that the eruption of Mount Etna is closely connected with it. Several old houses fell at the first shock.

THE additions to the Zoological Society's Gardens during the past week include a Bonnet Monkey (*Macacus radiatus*) from India, presented by Mr. A. S. Gissing; two Common Herons (*Ardea cinerea*), British, presented by Mr. R. H. Rabbetts; a Common Barn Owl (*Strix flammea*), British, presented by Mrs. A. Wright; a Slender-billed Cockatoo (*Licmetis tenuirostris*) from South Australia, deposited; two Red-billed Tree Ducks (*Dendrocygna autumnalis*) from America, a Zenaida Dove (*Zenaida amabilis*) from the West Indies, purchased; a Hairy-rumped Agouti (*Dasyprocta prymnolopha*) from Guiana, received on approval.

BIOLOGICAL NOTES

APPARENT BIRD-TRACKS BY THE SEA-SHORE.—At a recent meeting (October 3) of the Academy of Natural Sciences of Philadelphia, Mr. Thomas Meehan called attention to what appeared to be the tracks of a three-toed bird in the sand near low water-mark, at Atlantic City. These tracks were of a nature that would be readily recognised by observers as bird-tracks; but while thinking of what bird could have caused them, and reflecting on the phenomenon of their being only found on the sand near low water-mark, Mr. Meehan noted on the face of the smooth, receding waves, spots where the water sparkled in the light, and he found this was caused by little riplets as the wavelets passed down over the half-exposed bodies of a small crustacean (*Hippa talpoidea*), and that the water, in passing over the bodies made the trifid marks which had been taken for impressions of bird's feet. These little crustacea take shelter in the sand near low water-mark, and enter head foremost in a perpendicular direction downwards, resting just beneath the surface. The returning wave took some of the surface sand with it, and then the looser portions of the bodies uppermost in the sand were exposed. Often the little creatures would be quite washed out; when recovering themselves, they would rapidly advance in a direction contrary to the retreat of the wave, and would enter the wet sand again as before, their sides being parallel with the shore. Their bodies terminate in a caruncular point which, with the position of the two hind-legs, offer a tridentate obstruction to the sand brought down by the retreating wave, and the water passing round the points made the three toe-like grooves, which resembled a bird's foot from one and a half to two inches long. The crustacea, in their scrambles for protection beneath the sand, managed to keep at fairly regular distances from each other, and hence there was considerable regularity in the tracks, as if they had really been produced by birds. Although the author of these notes presented them as a trifle, yet it will be at once apparent that they are of great interest. Trifid impressions like these, filled with mud and the deposit then to become solid rock, would puzzle, if not altogether mislead, future observers.

AUSTRALIAN FRESHWATER SPONGES.—Up to this date, but one species of freshwater sponge has been described from Australia, *Spongilla capewelli* of Bowerbank; but Mr. W. A. Haswell, at a meeting of the Linnean Society of New South Wales (May 31, 1882) describes two new species from a pond near Brisbane, and one from the River Bell at Wellington. *Spongilla sceptroides* is a green, smooth, encrusting species, with the skeletal spicules very slightly curved, acute at both ends, ornamented with very minute projecting points. The statoblasts are spherical, defended by long, slender, straight, cylindrical spicules, which are armed with numerous acute spinules, chiefly collected around the extremities, forming heads; it is found growing on submerged twigs. *S. botryoides* is a yellowish flat-encrusting species, with curved skeletal spicules, fusiform, acute, with scattered, extremely minute, projecting points. Statoblasts protected by a crust of short, strongly-curved spicules, with heads at each end of numerous short, blunt, or sub-acute spines, somewhat botryoidal-like, the shaft smooth. This species was found with the first: another species fonnd by Mr. E. P. Ramsay in the Bell River, growing on masses attached to submerged timber seems nearly related to *S. Meyeni*, from Bombay. In colour it varies from a grass green to a yellow. It is massive, lobulated, with oscula between the projections. The skeleton spicules are perfectly smooth, and the amphidiscs are provided with from one to ten acute and prominent spines. Another species from somewhat deep water is indicated by Mr. Haswell.

EARTH-WORMS IN NEW ZEALAND.—The following interesting observations form part of a communication from Mr. A. T. Urquhart, to the editor of the *New Zealand Journal of Science*, and appear in the September number of that periodical. In October, 1875, I dug a trench on some newly-cleared land—a raised beach at Manukau Harbour. The section then showed about 4½ inches of black mould and a horizontal layer, 1 inch thick, of burnt clay, wood-ashes, small stones, and pumice lying on a brownish-green arenaceous clay. The vegetation cleared was the growth of some thirty years. A portion of the land was left undisturbed. Measurements again taken a few days ago gave an average depth of 1¼ inches of turf, 5¾ inches of black mould, and there was no perceptible difference in the layer of ash. An angular block of Trachyte—about twenty-five pounds in weight—placed in May, 1875, had sunk 1 inch, allowing for the turf. As the results of some accurate calculations, as to the number of worms per acre, Mr. Urquhart gives results so considerably higher than Henson's, that he would have hesitated to publish them, were he not in a position to prove them. Henson, it will be remembered by the readers of Darwin on "Vegetable Mould," calculates that there are 53,767 worms per acre in garden mould, and above half that number in corn-fields. Mr. Urquhart's estimates, founded on digging about a quarter of an acre, as well as by a large number of tests on various parts of the fields, some that were under pasture for over sixteen years, gave from four to twenty-six earth-worms per each square foot. The alluvial flats, slopes, and richer portions of the upper lands would average eight to the square foot or say 348,480 per acre. In the uncultivated fern lands worms are scarce. In New Zealand worms not only leave their burrows, but climb up trees in search of food, this chiefly in the night time, though often until a late hour on damp warm mornings.

THE GENESIS OF THE HYPOPHYSIS IN PETROMYZON PLANERI.—Prof. Anton Dohrn, of Naples, writes:—"In his contributions to the history of development of the Pertromyzons (*Morphol. Jahrbuch*, vol. vii. p. 158), Mr. W. B. Scott says: 'The organ of smell is one of the most peculiar parts of the whole organisation of the Cyclostoms. . . . . The position of the organ is a symmetrical from the very beginning. It first begins to manifest itself as a shallow depression above the mouth, which we may regard as a common depression for the nasal cavity and the hypophysis. The ectoderm covering the head becomes suddenly thickened at one spot, in order to form the special smell sense epithelia which lie close to the front extremity of the brain. The cells at the bottom of the depression decrease in depth, while the cells that cover the opposite wall of the depression (*i.e.* the continuation of the upper lip) are very low.' Balfour ("Comp. Embryology," vol. ii. p. 358) makes the following criticism upon this statement:—"I have not myself completely followed the development of the pituitary body in Petromyzon, but I have observed a slight diverticulum of the stomodaeum, which I believe gives origin to it. Fuller details are in any case required before we can admit so great a divergence from the normal development as is indicated by Scott's statements." According to researches which I made this summer, the question is solved, but in a way different from either Balfour's or Scott's suggestions. The hypophysis arises rather as an independent depression of the ectoderm between the depressions for the nose and the mouth. Its connection with the nasal depression is only secondary, and is caused by the strong and early development of the upper lip. It has no connection with the mouth depression, because the upper lip develops between the mouth depression and the hypophysis. The particulars of these relations will appear in the next number of the "Studies in the Early Development of Vertebrates" in the *Proceedings* of the Zoological Station at Naples (*Zool. Anzeiger*, November 6, 1882).

FORMIC AND ACETIC ACID IN PLANTS.—Dr. Bergmann sums up the results of his investigations as to the occurrence and import of formic and acetic acids in plants as follows:—1. Formic and acetic acids are met with as constituents of protoplasm throughout the whole of the vegetable kingdom in the most various portions of the plant-organism, and both in chlorophyllaceous and non-chlorophyllaceous forms.

2. Formic and acetic acids are to be regarded as constant products of metastasis in vegetable protoplasm. 3. It is probable that other members also of the unstable group of fatty acids, as for instance, proprionic acid, butyric acid, caproic acid, or even the whole group, are universally distributed in the vegetable kingdom. 4. An increase of the amount of unstable acids takes place in a plant-organism when its assimilation is interfered with by deprivation of light, *i.e.* when put into a state of starvation (inanition). 5. Formic and acetic acids accordingly belong to the constituents of regressive tissue-metamorphosis. It has been premised that the homologous, unstable fatty acids have a similar import in vegetable tissue-metamorphosis. 6. No increase in the amount of unstable acids takes place in a plant-organism, which is withdrawn for a period from the light, under the minimum-temperature required for growth. 7. Accordingly the formation of formic and acetic acids in a plant seems to take place to a certain degree independently of respiration. 8. Acetic and formic acids are mainly to be regarded as decomposition products of the constituents of vegetable protoplasm.

GEOGRAPHICAL NOTES

DR. WISSMANN, of the German African Society has, it is stated, just arrived at Zanzibar, having left Loando in April, 1881, in company with Dr. Pogge. Striking inwards across the numerous streams that take their origin in the great watershed which separates the Congo and Zambesi basins, the travellers were at Mukenge, about 6° S. and 22° E., in November last year. Shortly after they set out for Nyangwe on the Lualaba, whence Wissmann proceeded eastwards to Zanzibar, while Pogge turned back to Mukenge, there to plant a station. The details of this journey will doubtless be full of novelty and interest.

THE German African Society has recently issued a report upon its latest undertakings. There are now four German expeditions in Africa, two proceeding from the east, and two from the west. In the east there is Dr. Stecker, who as the companion of Dr. Rohlfs, paid a visit to King John of Abyssinia, and then continued his journey through the Soudan. His last letter is dated February 15. Dr. Böhrn aud Dr. Kayser, who belong to Capt. von Schöler's expedition, report upon a three months' journey to Lake Tanganyika, from which they returned to the station at the end of 1881. From the Gondo Station itself Herr Paul Reichard, who remained there, sends a report; Capt. v. Schöler, after founding a station at Kakama, proceeded to Zanzibar. News has also been received regarding the exploration of the Wala River, to the west of Gondo, as far as its mouth, by Dr. Böhrn and Herr Reichard. On the other hand, Robert Flegel is busily at work. He has taken a minute cartographical survey of the hitherto unknown part of the Niger, between Inuri and Shay. In the spring of 1881 he prepared for a journey to Southern Adanana. He reached Keffi at the beginning of December; thence he intended to proceed by way of Schiber, on the Binne River, through the "heathen lands" to Kantscha and Yola, south of the Binne, then winter there, and thence proceed by water from Meo Kebbi to the Tubori Marsh to Kuka.

AT the beginning of November, Dr. Arthur Krause returned to Germany from his journey to the Chukchi Peninsula and Alaska, which he undertook, partly in company with his brother, Dr. Aurel Krause, and partly alone, at the instance of the Bremen Geographical Society. Dr. Aurel Krause returned to Germany last summer by way of Panama, while his brother remained in Alaska until the autumn. The two brothers have made copious collections of natural history and ethnographical specimens.

THE November number of *Petermann's Mittheilungen* contains an account by Dr. Gerhard Rholfs of the results of his recent journey in Abyssinia. Dr. Ferd. Löwl, of Prag, has a long and able paper on the origin of transverse-valleys; Lieut. Kreitner describes the route from Ansifan through the Gobi desert to Hami; while there are interesting letters from Emin-Bey, Lupton-Bey, and Dr. Junker, mainly referring to the work of the Russian explorer in the Welle region. He has been doing much to clear up the hydrography of the region, and has come to the conclusion that the Welle is really the upper course of the Shari, while the Aruwimi, the great tributary of the Congo, rises further to the east.

A SPECIAL supplement to the *Chamber of Commerce Journal* contains an account by Mr. Colquhoun of his recent journey through Yunnan to Burmah, accompanied by an excellent map. Under the title of "Across Chrysê," Messrs. Sampson Low and Co. will shortly publish a detailed narrative, with many illustrations, of Mr. Colquhoun's journey.

THE ordnance survey of Scotland, a work which has been going on for thirty-seven years, has been completed, and the surveying staff will be withdrawn from Scotland next week. During the last few years nearly a hundred men have been employed in the work.

THE Emperor of Russia has ordered 2200*l.* to be allotted from the Imperial Treasury to the Russian traveller in New Guinea and the Malay Archipelago, M. Miklucho Maklay, in order to enable him to work up the results of his explorations. His Majesty has also ordered M. Maklay to be informed that the cost of the publication of his book of travels will be defrayed by the privy purse.

THE PELAGIC FAUNA OF FRESHWATER LAKES

SEVERAL naturalists have within recent years made the pelagic fauna of freshwater lakes in various regions a subject of study. In the *Archives des Sciences* for September, Prof. Forel gives a list of those researches, with a *résumé* of the results they have yielded.

This fauna has but few species; but the number of individuals of each species is, on the other hand, enormous. The following is an enumeration of the species observed:—

OSTRACODA: *Cypris ovum*. CLADOCERA: *Sida crystallina*, *Daphnella brachyura*, *D. pulex*, *D. magna*, *D. longispina*, *D. hyalina*, *D. cristata*, *D. galeata*, *D. quadrangula*, *D. mucronata*, *Bosmina longirostris*, *B. longispina*, *B. longicornis*, *Bythotrephes longmanus*, *Leptodora hyalina*. COPEPODA: *Cyclops coronatus*, *C. quadricornis*, *C. serrulatus*, *C. tenuicornis*, *C. brevicornis*, *C. minutus*, *Heterocope robusta*, *Diaptomus castor*, *D. gracilis*.

The author excludes from consideration those animals that enter into the pelagic fauna in an accidental and accessory way, such as fishes (especially *Coregonus*), preying on the entomostraca, and other fishes which prey on those, also infusoria living on pelagic algæ, and animals coming occasionally from the border or the bottom of a lake.

The pelagic fauna is, in its general *traits*, very much the same in all European lakes where it has been examined, from the plains to the Alps, from Scandinavia to Italy. But it is rarely represented in one lake by all animals of the fauna. Pavesi has made a very complete study, in this respect, of the Italian lakes, giving, for each, a complete list of the species found. But an observation by Weissmann has to be remembered here. He found that the different species of Cladocera presented an annual periodicity; they disappear at certain seasons (different for different species), when they are represented only by eggs. Thus the list of pelagic animals of a lake, to be complete, must be based on numerous takes in different seasons.

The common characters of the fauna accord with the mode of life, which involves constant swimming; thus the animals have no organ of fixation, but a well-developed organ of natation. Their density, nearly equal to that of water, enables them to float between two waters without exerting themselves much. Their movements are slow, and they escape enemies rather by their transparence than by agility. This transparence is, indeed, their essential character; they do not generally show a visible point, except that of their eye, which is strongly pigmented with black, brown, or red. The quality of transparence may be interpreted as a case of mimicry.

The food of the fauna is vegetable or animal. Some feed on pelagic algæ, few in species, *Anabæna circinalis*, *Pleurococcus angulosus*, *Pl. palustris*, *Tetraspora virescens*, *Palmella Ralfsii*, but very abundant in individuals; others pursue and eat the smallest animal species living in the same waters.

The pelagic animals present daily migrations; swimming near the surface at night, and remaining in the depths by day. Fric thought he found, in the Bohemian lakes, each species select a determinate depth; neither Pavesi nor the author have observed such constancy. The different species form groups, or troops, where the net makes rich captures, but these banks of animals of the same species, have not, at least in the large Swiss lakes, a determinate fixed position.

As to the maximum depth at which they are found, Prof. Forel has taken them in Lake Leman as deep as 100 and even 150 metres; at the greatest depths only *Diaptomus*.

The optic nerve of those animals probably suffers from too bright light, and so they descend whenever the light of sun or moon becomes too strong; still, they require some light to seek their prey. In their migrations they traverse a considerable thickness of water. What is the limit of light in freshwater lakes? The author showed in 1877, that the transparence varied with the season; it is much greater in winter than in summer. Under the most favourable conditions, a bright object sinking in the water of Lake Leman disappears at about 16 or 17m. depth. Paper sensitised with chloride of silver gave as light-limit in Lake Leman 45 m. in summer, and 100 m. in winter. Asper, using more sensitive plates (prepared with bromide of silver emulsion), found the *actinic* rays still active in the Lake of Zurich at 90 m. and more. All this, however, does not determine the limit of absolute obscurity for the retina, and especially for the optic nerve of lower animals.

With regard to the origin of this pelagic fauna, Prof. Forel confidently rejects the idea of local differentiation of litttoral species in each lake, producing the pelagic fauna of the lake. The very remarkable character of generality, the almost absolute identity of the pelagic entomostraca in all European lakes point to dissemination and mixture.

How has this dissemination occurred? Active migration from one lake to another is inadmissible, considering obstacles and power of locomotion. On the other hand, a passive migration in the state of winter eggs, attached to the feathers of birds of passage, ducks, grebes, gulls, &c., explains the transport sufficiently. Pavesi has argued against this common origin and mode of dissemination, on account of irregularity in the pelagic population of different Italian lakes, certain species being absent in certain lakes, while they are represented in neighbouring lakes. But this irregularity seems to the author to correspond perfectly with the accidental and fortuitous character of the mode of dissemination referred to. "If this mode of transport be admitted, the differentiation of pelagic species is no longer necessarily localised in the lake in which we find the animals, any more than in the present geological epoch. This fact is very important for explanation of the pelagic fauna of certain lakes the origin of which is comparatively modern; for our Swiss lakes, the glacial epoch forms an absolute limit which prevents our supposing a local differentiation of ancient tertiary species, and their transformation into our present species; the origin of the pelagic faunas of certain Italian lakes of volcanic nature, is still more modern. But since we are no longer limited to a local differentiation of autochthonous species, we find more time and more space for this process of differentiation."

Prof. Forel believes the cause of differentiation of pelagic fauna will be found in a combination of two facts, viz., the daily migrations of entomostraca, and the regular local breezes on large lakes. There are two such breezes in calm weather, one blowing from the land at night, the other from the water by day. Crepuscular animals of the shore region, which come to swim on the surface at night, are carried out into the lake by the surface-current of the land breeze. By day the light sends them down, and thus they escape the surface current of the breeze that would bring them back to the shore. Carried each night further out, they become finally relegated to the pelagic region. Differentiation by natural selection then operates, and after a few generations, there remain only the admirably transparent animals and excellent swimmers we know. This differentiation once effected, the pelagic species is transported by the migratory birds from one country to another, from one lake to another, where it is multiplied, if the conditions are favourable. Thus we may find, even in lakes too small to possess an alternation of breezes, true pelagic Entomostraca that have been differentiated in other larger lakes by the play of such breezes. The differentiation of most pelagic species may thus be easily accounted for.

There are two species, however, the author points out, whose origin is not so explained; these are the most beautiful and interesting of pelagic Entomostraca: *Leptodora hyalina* and *Bythotrephes longimanus*. These two Cladocera have no known parentage in the freshwater species forming either the shore fauna of lakes or the marsh or river fauna. We must, with Pavesi, seek a marine origin for them. *Bythotrephes* probably descended from a common ancestor with Podon, its nearest parent, and the *Leptodora* from a primitive Daphnis.

How did the passage from salt to fresh water take place? Pavesi supposes closure of a fjord and gradual transformation of the lake water in consequence. Prof. Forel further suggests as possible, passive migration and successive transport to lagoons less and less salt; and there may have been other ways. We have not the elements for settling the question. "But the adaptation to fresh water once accomplished, the dissemination of these forms of marine origin has certainly taken place like that of other pelagic fresh-water forms, and those two species have so been transported into lakes which have never had direct communication with the sea."

There are evident analogies, Prof. Forel remarks in closing, between the lacustrian and the marine pelagic fauna; the differences appear chiefly in relative size and proportions. In the sea all is on a large scale; in lakes, on a small; the number of species and of individuals, the size, the extent of the migrations, the area of extension. But, with this exception, the general laws are the same in the two analogous faunas.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

FOUR chairs in the University College, Dundee, have been filled up as follows:—Mr. Steggall, Fielden Lecturer in Mathematics, in Owens College, Manchester, was appointed Professor of Mathematics; Mr. Carnelly, Professor of Chemistry in Firth College, Sheffield, was appointed Professor of Chemistry; Mr. Ewing, Professor of Engineering in the University of Tokio, Japan, was appointed to the Chair of Engineering; and Mr. Thomas Gilray, M.A., Head Master in English at Glasgow Academy, to the Chair of English Literature and Modern History. The salary guaranteed to each professor is 500*l*.

THE University of Zürich will, at the end of the current winter term, celebrate the fiftieth anniversary of its foundation.

SCIENTIFIC SERIALS

The Journal of Anatomy and Physiology, vol. xvii. Part 1, October, 1882, contains:—On the lymphatics of the walls of the larger blood-vessels, and lymphatics, by Drs. George and Elizabeth Hoggan.—On micrococcus poisoning, by Dr. A. Ogston.—On omphalo-mesenteric remains in mammals, by Dr. W. Allen.—On the action of saline cathartics, by Dr. M. Hay.—On a hitherto undescribed fracture of the Astragalus, by Dr. F. J. Shepherd.—On a secondary astragalus in the human foot, by Prof. W. Turner.—Note on the rectus abdominalis et sternalis muscle, by Dr. G. E. Dobson.—On a case of ectopia vesicæ, &c., in a newly-born infant, by Dr. F. Ogston.—On nickel and cobalt; their physiological action on the animal organism. Part i., Toxicology, by Dr. T. P. A. Stuart.—A kerato-thyro-hyoid-muscle as a variation in human anatomy, by S. G. Shattock.—On Cesalpino and Harvey, by Prof. Humphry.

The Proceedings of the Linnean Society of New South Wales, vol. vii. part 1 (Sydney, 1882), contains: Wm. A. Haswell, on the structure of the paired fins of Ceratodus (plate 1).—Notes on the anatomy of *Ædirhinus insolitus* and *Turacæna crassirostris*.—Wm. Macleay, on Port Jackson Pleuronectidæ, with descriptions of new species; on the fishes of Palmer River; on an Alpine species of Galaxias.—E. P. Ramsay, the zoology of the Solomons, Part IV.; on a new species of Mus from Ugi Island; contributions to Australasian oology (plates 3-5); on the zoology of Lord Howes Island; on *Apogon guntheri* of Castelnau; on some Fijian bird's eggs.—Alex. Morton, notes of a cruise to the Solomons.—Prof. F. W. Hutton, note on *Fossarina petterdi*; list of New Zealand freshwater shells.—Rev. Dr. Wools, the plants of New South Wales, No. 8.—Rev. J. E. T. Woods, botanical notes on Queensland; on a new species of Stomopneustes, and a new variety of *Hipponoe variegata*; on fossil plants of Queensland.—J. Brazier, fluviatile shells of New South Wales; a list of Cyprædæ of the Victorian coast.—Wm. Mitten, on some Polynesian mosses.—Rev. C. Kalchbrenner, new Australian fungi.—Dr. J. C. Cox, on the edible oysters of Australia.

Journal and Proceedings of the Royal Society of New South Wales, vol. 15, 1882, contains: On the climate of Mackay, by H. L. Roth.—Notes of a journey on the Darling, by W. E. Abbott.—The astronomy of the Australian aborigines, by Rev. P. MacPherson.—On the spectrum of the recent comet; on

new double-stars; on the transit of Mercury, November 8, 1881, by H. C. Russell.—On the inorganic constituents from epiphytic ferns, by W. A. Dixon.—A census of the genera of plants native to Australia, by Baron Ferd. von Mueller.—On water storage and canalisation for the colony, by F. B. Gipps.

Rivista Scientifico-Industriale e Journale del Naturalista, September 15.—Luni-solar influence on earthquakes, by F. L. Bombicci.—On the transformation of electricity into voltaic currents, and the application of these currents, by G. Govö.—Doderlein's ichthyological manual of the Mediterranean, by E. Riggio.

Archives des Sciences Physiques et Naturelles, September 15.—On the rotatory polarisation of quartz (third part), by MM. Soret and Sarasin.—The pelagic fauna of freshwater lakes, by F. A. Forel.—Researches on the quantity of carbonic acid contained in the atmospheric air, by E. Risler.—The air thermometer arranged with a view to a determination of high temperatures in practice, by H. Schneebeli.—Remarks on M. Louis Lossier's work, entitled "Electrolytic Calculations," by C. E. Guillaume.—Geometric proof of the theorem of Wheatstone's bridge, by the same.—Emile Plantamour.

Bulletin de l'Academie Imperiale des Sciences de St. Petersbourg, Part xxviii., No. 2.—New researches on artificial double stars, by O. Struve.—Topographical observations of Jupiter, by J. Kalazzi.—On the oxidation of isodibutylene by hypermanganate of potash, by A. Boutlerov.—Observations of the planets Jupiter, Saturn, and Neptune in their oppositions in 1881, by A. Sowitsch.—Determination of the mass of Jupiter by means of observations of the reciprocal distances and the directions of his satellites, by O. Backland.—Action of zinc-methyl on chloral, by B. Rizza.—De Marci Antonini Commentariis, by A. Nauck.—Hydrological researches (continued), by C. Schmidt.

Zeitschrift für wissenschaftliche Zoologie, Bd. 37, Heft. 2, September 27, 1882, contains: Contributions to the anatomy of *Ankylostoma duodenale* (Dubini) = *Dochmius duodenalis* (Leuckart), by Wm. Schulthess (plates 11 and 12).—On the ontogeny of *Keniera filigrana* (O. Schmidt), by Wm. Marshall (plates 13 and 14).—Contribution to a knowledge of the structure and functions of the heart in osseous fishes, by Kasem-Beck and J. Dogiel, of Kasan (plates 15 and 16).—Contribution to a knowledge of the cestoid worms, by Dr. Z. von Roboz (plates 17 and 18).—Comparative embryological studies of Elias Metschnikoff, No. 3, on the gastrula of some Metazoa (*Echinus miliotuberculatus*, *Lineus lacteus*, *Phoronis hippocrepina*, *Polygordius flavocapitatus*, *Ascidia mentula*, and *Discoporella radiata* (plates 19 and 20).

Morphologisches Jahrbuch eine Zeitschrift für Anatomie und Entwickelungsgeschichte, bd. viii. heft 2, 1882, contains:—Contribution to the Angiology of the Amphibia, by Dr. J. E. V. Boas (with plates 6 to 8).—On the nasal cavities and the lachrymo-nasal canals in the amniotic vertebrata, by Dr. G. Born (with plates 9 and 10).—New foundations for a knowledge of cells, by Dr. A. Rauber (with plates 11-14).—Observations on the development of the crown of tentacles in Hydra, by H. Jung.

SOCIETIES AND ACADEMIES

LONDON

Linnean Society, November 2.—Sir J. Lubbock, Bart., in the chair.—Prof. J. C. Ewart, G. Fry, and Lord Walsingham were elected Fellows of the Society.—Mr. A. P. W. Thomas drew attention to a series of specimens under the microscope, and diagrams illustrative of the life history of the Liver Fluke (*Fasciola hepatica*). His experiments show that the embryos of the Fluke, as free Cercariæ, burrow into and develop within the body of *Linnæus truncatulus*, and thereafter pass with the herbage into the stomach, and ultimately liver of the sheep. Salt added to the sheep's diet is found to act as a prophylactic.—Mr. W. T. Thiselton Dyer exhibited specimens and made remarks on the plant producing *Cassia lignea*, and on the native implements used in the collection and preparation of the Cassia bark in Southern China.—Mr. C. T. Druery showed two proliferous forms of *Athyrium filix fœmina*, a family hitherto remarkable for its unproliferous nature. Both examples appeared simultaneously; not the least significant feature being their extreme precocity, since bulbil-bearing ferns are proliferous-usually only on their mature fronds.—Mr. F. Crisp exhibited preparations in illustration of the views of Drs. Loew and Bokormy on the difference between dead and living protoplasm, viz. the power of the living organism to reduce silver salts in a very dilute alkaline solution.—Prof. E. Ray Lankester exhibited and made remarks on a series of marine organisms dredged by him, last summer, in the fjords of Norway. Of these may be mentioned a branch of *Paragorgia arborea*, three feet across, specimens of the same in spirit, as also of *Lophelia prolifera*, *Amphiheria ramea*, *Stylaster norvegicus*, *Primnoa lepadifera*, and *Paramuricia ramosa*, both dried, and also with the polyps preserved in spirit. The collection also included some very large new forms of Foraminifera specimens of *Rhizocrinus Lofotensis*, of the aberrant mollusca *Neomenia* and *Chætoderma*, and of *Rhabdopleura Normani*, besides a large series of sponges and Asteroidea.—Mr. T. Christy exhibited a living specimen of the Japanese peppermint plant, which yields the Menthol of commerce, this being the first plant grown in this country. Mr. Holmes mentioned that although this mint did not differ in botanical characters from *Mentha arvensis*, it had a strong peppermint odour and flavour, which were not found in the specimens growing either in Europe or India. He therefore proposed that the plant should be named *M. arvensis*, var. *piperaneus* by way of distinction.—Mr. J. G. Baker showed a specimen of *Lycopodium complanatum* collected in Skye by Prof. Lawson.—Sir J. Lubbock then read his tenth communication on the habits of ants, bees, and wasps, a notice of which appeared in our last issue, p. 46.—A paper was read on medicinal plants of North-West Queensland, by W. E. Armit. Among these is a species of *Aristolochia* and a Croton; also *Grewia polygama*, a specific for dysentery; *Careya arborescens*, used for poultices; *Erythreæ australis*, and *Andropogon citriodora*, tonics in febrile complaints; and *Euphorbia pilulifera* and *Datura australis*, valuable in cases of asthma.—A remarkable malformation of the leaves of *Beyeria opaca*, var. *linearis*, from Yorkes Peninsula, South Australia, was described by Mr. Otto Tepper.—Dr. F. Day exhibited specimens in illustration of a paper read by him, on variation in form and hybridism in *Salmo fontanalis*.—Mr. H. N. Ridley afterwards read some teratological notes on a Carex, a Grass, and an Equisetum

Zoological Society, November 14.—Prof. W. H. Flower, F.R.S., president, in the chair.—A letter was read from Mr. E. L. Layard respecting a specimen of *Schœnicola platyura* received by the British Museum from the late Mr. Cuming.—Prof. F. Jeffrey Bell exhibited some examples of *Lymnæus truncatulus*, lately discovered to be the chief host of the larvæ of the sheep-fluke.—Prof. Flower exhibited and made remarks upon the skull of a young chimpanzee from Lado, in the Soudan, sent to him by Dr. Emin Bey, which exhibited the deformity called "Acrocephaly," associated with the premature closure of the fronto-parietal suture.—Mr. H. E. Dresser exhibited and made remarks on specimens of *Melittophagus boehmi*, Reichenow, and *Merops dresseri*, Shelley, which he showed to be identical.—A communication was read from Mr. W. A. Forbes containing some supplementary notes on the anatomy of the Chinese Water Deer (*Hydropites inermis*).—A communication was read from the Rev. L. Baron, containing notes on the habits of the Aye-Aye of Madagascar in its native state.—Mr. G. E. Dobson read a paper on the natural position of the family Dipodidæ, which he maintained to be with Hystricine, and not, as generally supposed, with the Murine Rodents, and to be most nearly allied to the Chinchillidæ.—Prof. F. Jeffrey Bell read a paper on the genus *Psolus*, relating its literary history, and giving an enumeration of the described species. Attention was directed to the extensive distribution of *P. fabricii*, and to the variations during growth. After the description of other known forms, two new species (*P. peronii* and *P. ambulata*) were described; for the latter a new sub-genus was suggested, and the genus itself was divided into three sub-generic groups.—A second paper from Prof Bell contained an account of a Crinoid from the Straits of Magellan, obtained by Dr. Coppinger during the voyage of H.M.S. *Alert*, which was referred to a new variety of *Antedon eschrichti* of the Arctic seas.—Mr. W. H. Neale read some notes on the natural history of Franz-Josef Land, as observed in 1881–82, during the stay of the *Eira* expedition in that land.—Dr. Gwyn Jeffreys read the fifth part of his list of the Mollusca procured during the expeditions of H.M.S. *Lightning* and

Porcupine. This part, which embraced the species from the Solenoconchia to the Calyptræidæ, comprised sixty-nine species, of which twenty two were now for the first time described or figured. The geographical, hydrographical, and geological range of all these species was given, as in his former papers; and the author especially noti ed the points of agreement between the deep-water Mollusca from the American and European expeditions.

Physical Society, November 11.—Prof. Clifton, president, in the chair.—Prof. Rowland, of Baltimore, exhibited a number of his new concave gratings for giving a diffraction spectrum. He explained the theory of their action. Gratings can be ruled on any surface if the lines are at a proper distance apart and of the proper form. The best surface, however, is a cylindrical or spherical one. The gratings are solid slabs of polished speculum metal ruled with lines equidistant by a special machine of Prof. Rowland's invention. An account of this machine will be published shortly. The number of lines per inch varied in the specimens shown fro n 5000 to 42,000, but higher numbers can be engraved by the cutting diamond. One great advantage of their use is that the relative wave-lengths can be measured by the micrometer with great accuracy. The author has designed an ingenious mechanical arrangement for keeping the photographic plates in focus. In this way photographs of great distinctness can be obtained. Prof. Rowland exhibited some 10 inches long, which showed the E-line doubled, and the large B groups very clearly. Lines are divided by this method which have never been divided before; and the work of photographing takes a mere fraction of the time formerly required. A photographic plate sensitive throughout its length is got by means of a mixture of eocene, iodised collodion, and bromised collodes. Prof. Rowland and Capt. Abney, R.E., are at present engaged in preparing a new map of the whole spectrum with a focus of 18 feet. In reply to Mr. Hilgar, F.R.A.S., he stated that if the metal is the true speculum metal used by Lord Rosse, it would stand the effects of climate he thought; but if too much copper were put in it might not. In reply to Mr. Warren de la Rue he said that 42,000 was the largest number of lines he had yet required to engrave on the metal.—Prof. Guthrie read a letter from Capt. Abney, pointing out Prof. Rowland's plates gave clearer spectra than any others; they were free from "ghosts" caused by periodicity in the ruling; and the speculum metal had no particular absorption.—Prof. Dewar, F.R.S., observed that Professor Liveing and he had been engaged for three years past in preparing a map of the ultra-violet spectrum, which would soon be published. He considered the concave gratings to make a new departure in the subject, and they would have greatly facilitated the preparation of his map.—Mr. W. R. Browne then read a paper on the conservation of energy and central forces. He showed that the doctrine of the conservation of energy necessarily involved central forces and could not be proved unless on the assumption of a system of central forces. This involved the hypothesis of Boscovich that matter consists of a collection of centres of force, and the author criticised the objections of Clerk Maxwell, Tait, and others to Boscovich's theory. The paper will appear in the *Transactions* of the Society.—Prof. S. P. Thompson read some historical notes on physics, in which he showed that the voltaic arc between carbon points was produced by a Mr. Etienne Gaspar Robertson (whose name indicates a Scotch origin) at Paris in 1802. This reference is found in the *Journal de Paris* for that year. Laboratory note-books at the Royal Institution, however, are said to show that Davy experimented with the arc quite as early. The experiment usually attributed to Franklin of exhausting air from a vessel of water "off the boil" and causing it to boil afresh, is found in Boyle's "New Experiments touching the Spring of the air. Prof. Thompson also exhibited an early Reis's telephone, made by Philip Reis in 1861 at Frankfort, and designed to transmit speech. It was modelled on the human ear, one form of transmitter being a rudely-carved wooden ear, with a tympan, haxing a platinum wire behind, hard pressed against a platinum-tipped adjustible spring. Prof. Thompson showed by various proofs that words were actually sent by that and similar apparatus.

Meteorological Society, November 15.—Mr. J. K. Laughton, F.R.A.S., president, in the chair.—Eleven new Fellows were elected, viz. Rev. J. Brunskill, F. B. Buckland, C. F. Casella, W. H. M. Christie, F.R.S., A. Cresswell, R. S. Culley, C. Morris, O. L. O'Connor, H. Parker, F.Z.S., A. Rowntree, and D. R. Sharpe.—The papers read were: On certain types of British weather, by the Hon. Ralph Abercromby, F.M.S. The author shows that there is a tendency of the weather all over the Temperate Zone to occur in spells associated with certain types of pressure distribution. In Great Britain there are at least four persistent types—the southerly, the westerly, the northerly, and the easterly. In spite of much fluctuation, one or other of these types will often continue for weeks together, and tend to recur at the same date every year. The value of the recognition of type groups is shown in the following ways:—(1) They explain many phenomena of weather and many popular prognostics; (2) in some cases they enable forecasts to be issued with greater certainty and for a longer time ahead; (3) we can by their means correct statistical results by giving the real test of identity of recurrent weather which no single item such as heat, cold, rain, &c., can do; (4) they enable us to treat such geological questions as the influence of changing distribution of land and sea on climate in a more satisfactory manner than any other method.—On the use of kites for meteorological observation, by Prof. E. Douglas Archibald, M.A., F.R.S. In this paper the author advocates the use of kites for meteorological observation, and describes the mode in which they may be best flown so as not to be mere toys, but scientific instruments, capable of ascending to great heights, remaining steady in currents of varying velocity, and of being manipulated with ease and rapidity by the observer.—The meteorology of Mozufferpore, Tirhoot, 1881, by Charles N. Pearson, F.M.S.

Institution of Civil Engineers, November 14.—The president, Sir W. G. Armstrong, C.B., F.R.S., in the chair.—The paper read was on "Recent Hydraulic Experiments," by Major Allan Cunningham, R.E., Honorary Fellow of King's College, London.

BERLIN

Physical Society, October 3.—Prof. Rœber in the chair.—Dr. Kœnig had already reported in a previous session on the Leukoscope, designed and constructed by Prof. Helmholtz, and communicated now the results of his further experiments with this instrument. It consists essentially of a calc-spar-rhomboid, a plate of quartz, and a Nicol's prism. A luminous pencil entering the calc-spar is split up into two rays polarised at right angles which traverse the quartz-plate and the Nicol. When spectroscopically analysed, these rays show two spectra of absorption-bands, in the spectrum of the one pencil at points where in the spectrum of the other pencil the intensity is undiminished, and *vice versâ*, so that the two spectra superposed would give a continuous spectrum. The number of bands increases with the thickness of the quartz, and they are shifted by rotating the Nicol. The *modus operandi* then is to put in a quartz plate of such a thickness, and to rotate the Nicol so much that in each of the spectra the colours that are not blotted produce together white light. When different sources of light are examined with the leukoscope, the different amounts of rotation of the Nicol are required for effecting a conformity of the two images, the relative quantity of certain rays being different in every different light, the prevailing tint belonging therefore to the one, and not to the other spectrum. Further experiments having proved that the plate of quartz could remain unaltered, the rotation angles of the Nicol were a gauge of the quality of colours of the light examined. Dr. Kœnig has tried in this way a series of sources of light, and found the angles wanted for homogeneity of the white images to be as follows:—With stearin candles = 71°·20; with gaslight = 71°·5; with electric arc light = 79°; with magnesium light = 86°; with solar light = 90°·5; with burning phosphorus and Drummond lime-light the angles were between gas and electric-arc light. The succession of the sources of light thus stated coincides strikingly with the results of spectro-photometric measurements of Prof. Pickering. The fact that the magnesium light is more like the solar light than the electric arc light quite corresponds with the known fact that of the aniline dyes, scarcely distinguishable by gas-light, the greatest part can be perceived by electric light, but not all, viz. the so-called bronze hues; whereas by the magnesium light they are all as well distinguished as by solar light. Furthermore Dr. Kœnig has made many measurements with the leukoscope on different electric incandescent lights; with Swan's lamp and Edison's lamp he gave the results of his experiments in tables in which the strength of the current, the intensity of light, and the angles of the leukoscope were indicated. From these numbers it follows that luminosity augments at first at a much greater rate with increasing strength of current than the latter; by doubling the strength of the current

the illuminating power was increased about sixty-fold. The angles of the leukoscope became likewise greater with the rising intensity of the light in such a manner that a curve traced with the light intensities as abscissæ and the angles as ordinates is concave to the abscissæ and approaches assymptotically a maximum near 78°, an angle approximately equal to the angle (79°) of the glowing carbons of the electric arc light. The measurements with a Siemens' incandescent lamp gave also numbers which could be represented by a similar curve.

PARIS

Academy of Sciences, November 13.—M. Jamin in the chair.—The following papers were read:—Results of experiments made with electric candles at the Exhibition of Electricity, by M. Allard and others. The systems examined, those of Jablochkoff, Jamin, and Debrun, now produce nearly the same economical results.—On the reproduction of osmides of iridium, by M. Debray. Osmium and iridium may crystallise together in all proportions, without the form of their combination being altered. They are then isomorphous. And natural osmides may be true isomorphous mixtures, belonging to the cubic system, notwithstanding the hexagonal appearance of certain varieties (but this view is given with reserve, natural osmides being of complex composition).—Report to the Bureau des Longitudes on the approaching eclipse of May 6, 1883, by M. Janssen.—Note on the telluric lines and the spectrum of aqueous vapour, by M. Janssen. He recalls his own method, based on study of the spectrum of water vapour in a tube; he is now working at it. The *telluric lines* (so called by him) are historically quite different from the *bands of Brewster;* (an expression of M. Cornu's seemed to affirm their equivalence.)—On the currents produced by nitrates in igneous fusion, in contact with red hot carbon, by M. Brard. Owing to the tendency of fused nitrates to spread in heated bodies, a current may be had if a short carbon rod with one end put in the nitrate has only the other end incandescent; also if fused nitrate in a metal capsule is placed on burning carbon (the nitrate soaks through, so that the outer surface of the capsule becomes quite moist); indeed, such a capsule merely hung over a centre of combustion gives a current (from the nitrate bath to the outer surface of the capsule). The effect is improved by putting plumbago, or lampblack, on the outside, and covering all with metallic foil. Nitrates kept in fusion have great fixity.—Chemical studies on the white beet of Silesia (continued), by M. Leplay.—Observations made during the total eclipse of the sun of May 17, 1882, by M. Tacchini. He gives a *résumé* of his memoir, which will shortly appear.—On Abelian differential equations in the case of reduction of the number of periods, by M. Picard.—On a theorem of M. Tisserand, by M. Stieltjes.—Extension of the problem of Riemann to hypergeometric functions of two variables, by M. Goursat.—On the development of functions in series of other functions, by M. Hugoniot.—On the exactness of measurements made with the mercury thermometer, by M. Crafts. The pressure (of the air) has little influence. Permanent elevation of the fixed points, produced at a high temperature, preserves the thermometer against the influence of heat, in this respect, at lower temperatures.—Conclusions of hydrodynamic experiments in imitation of phenomena of electricity and magnetism; reply to a note of M. Ledieu, by M. Decharme. The theory of waves seems to him to be "the secret of nature," and he places the results of his experiments against the unverified ideas of M. Ledieu.—Electric deformations of quartz, by MM. Jacques and Curie. With delicate apparatus, they observed and measured such deformation when a charge was given to two pieces of tin at the opposite ends of the electric axis. The dilatations measured agreed satisfactorily with those calculated from the electricity liberated.—On the electrification of air, by M. Mascart. In the Amphitheatre of the College of France he electrified the air by discharging a Leyden jar with a flame, during ten seconds; another flame, 8 m. off, communicated with an electrometer in an adjoining hall. The maximum deflection in the latter was reached in about a quarter of an hour; then there was slow diminution, but after two hours 1-20th of the maximum still remained. The electrified gas probably rises and is diffused like smoke. To study the lower atmospheric layers, the potential should be determined in a large inclosure formed of metallic netting, connected with the ground.—On atmospheric nitrification, by MM. Muntz and Aubin. A constant absence of nitrates in meteoric waters was observed at the top of the Pic du Midi (nearly 3000 m.). A comparison of thunderstorms shows the summit to be generally above them. Atmospheric nitrification is probably produced in the lower regions of the air.—On the decomposition of phosphates at a high temperature by sulphate of potash, by M. Grandeau.—Point of solidification of various mixtures of naphthaline and stearic acid, by M. Courtonne.—On cœnocyanine, by M. Maumené.—On the cause of liberation of oxygen from oxygenated water by fibrine; influence of hydrocyanic acid exhausting the activity of fibrine, by M. Béchamp. He shows that the fibrine loses somewhat; and that it no longer decomposes oxygenated water nor fluidifies starch, nor gives bacteria.—On the signification of the polar cells of insects, by M. Balbiani.—On the vaso-dilator reflex of the ear, by MM. Dastre and Morat.—Phenomena of death from cold in Mammalia, by MM. Richet and Rondeau. The respiratory and cardiac functions may be suspended for half an hour, without death certainly ensuing. (Rabbits, shaved (*rasés*), were inclosed in flexible tin tubes, through which flowed salt water cooled to −7° C.).—Analogies and differences between curare and strychnine, as regards their physiological action, by M. Couty.—On the causes of migration of sardines, by M. Launette. Each migration is normally under the two conditions of food and temperature combined.—Contribution to the geological history of the iron of Pallas, by M. Meunier.

VIENNA

Imperial Academy of Sciences, October 12.—V. Oppolzer, finding the reduction to infinitesimal arcs of vibration at pendulum-observations.—H. Kreuter, computation of the trajectory of the comet 1771.—V. Barth and T. Schreder, on the behaviour of benzoic acid if dissolved in caustic potash.—N. Herz, the theory of computations of the trajectory of a comet.

October 19.—R. v. Lendenfeld, on a new self-registrating thermometer.—V. Oppolzer, on an eclipse of the sun mentioned by Archilochos.—W. Demel, on the Dopyrlerite of Ausser (Styria).—W. Gintl and F. Reinitzer, on the constituents of the leaves of *Fraxinus excelsior*, L.

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