THURSDAY, SEPTEMBER 10, 1874

THE INTERNATIONAL CONGRESS OF ORIENTALISTS

THE International Congress of Orientalists, which is about to be held in London, from the 14th to the 19th of September, promises fairly to become one of the most striking events of the autumn. This philological parliament is the successor and outcome of a similar Congress held last year in Paris, which inaugurated a movement likely to bear good fruit for a long time to come. The idea of holding once during every year a meeting of this nature in a different city originated with M. Gabriel Mortillet, a distinguished French *savant*, who proposed an annual International Congress of Prehistoric Archæology. Of these, the first was held at Neuchâtel, in Switzerland, in 1866. At the Brussels Congress of this body, two monarchs, the Kings of Denmark and Sweden, commissioned agents to represent them on the occasion, and their example was followed by the municipal authorities of Bologna. The French Congress of Orientalists of 1873 was mainly due to the exertions of M. Léon de Rosny, who organised its machinery with the co-operation of MM. Madier de Montjau and Zelinsky. The most prominent considerations of this Congress were directed towards the Japanese Empire, history, and language, and a very large and extremely interesting mass of literary and scientific material was accumulated, and is now in course of publication and distribution among the members of that meeting. This collection of essays is all the more important when we consider how few really accurate channels of knowledge concerning that remote country are available to the European student. Although the French Congress was supported by a greater number of members than the approaching London Congress seems at present likely to enrol, nevertheless it was not well attended; for the principal Orientalists who occupy *fauteuils* in the Institute held aloof from various motives, while on the other hand the *savants* of Germany, in consequence of the recent war, were, however willing, yet prevented by the French national feeling from making their appearance in the capital city. Yet by far the larger number of the most eminent professors in Germany enrolled their names on the list of the supporters of the Congress.

The London Congress has, however, no difficulties of this nature to surmount, and it will without doubt show a great preponderance of learned Germans; at the same time a reference to the list of members indicates a very strong contingent from the other side of the Channel. The vital principle of these Congresses is, that each, at the conclusion of its labours, transmits its powers to a chosen individual who becomes president for the ensuing year; this president is elected after the country has been fixed upon in which the next meeting is to be held. The Paris Congress, in accordance with this principle, selected London, as the metropolis of England, to be the place where the Congress of the current year should be held; and this was done out of respect for the learning of the country, although very flattering and advantageous offers had been made by other European countries, which would have perhaps accorded an official reception more cordial than is likely to be given by the imperial authorities in this country. At the conclusion of the French Congress in September last year, Dr. Samuel Birch, K.R., Keeper of the Egyptian and Oriental Antiquities in the British Museum, a gentleman whose knowledge of the whole range of ancient remains, whether Greek, Roman, or Oriental, makes him *facile princeps* in this particular study, was elected president of the English meeting, and an executive committee was afterwards nominated to carry out the necessary arrangements. These preliminary matters are now so far advanced that the programme has just been issued, and the sittings, which will occupy the entire week, will commence on Monday next, the 14th inst. These Congresses are likely to produce several very excellent effects, by bringing together distinguished Orientalists who would probably not otherwise become personally acquainted with each other; by the mutual interchange of ideas, by the bringing about some understanding on many disputed points, and by the arrangement of some uniform system of transliteration and transcription of Oriental texts. But above all it will call public attention to the importance of Oriental studies, alas! too long neglected in Great Britain, and will elevate in public opinion the position of Oriental students and studies, which already exercise, and will hereafter still more powerfully exercise, an influence over European thought.

The number of English members is at present about 180, daily increasing and comprising all the names distinguished in Oriental studies; indeed, it would be difficult to mention any Orientalist of leading note in England who is not a member of this Congress. In addition to these, Prof. Dr. Brugsch will represent Egypt. France will be represented by upwards of thirty members, of whom we may mention M. François Lenormant, Professor of Archæology at the French Institute; Prof. Jules Oppert, whose labours on the Cuneiform languages are well known; and Prof. Léon de Rosny, who was president of the Congress last year. Germany is also well represented, sending such men as Prof. Brockhaus of Leipzig, a leading expounder of the old school of Sanscrit learning, with whom we may unite the name of Prof. Stenzler of Breslau; Prof. Dillmann of Berlin, chiefly known for his Ethiopic researches and his valuable lexicon and catalogues of Ethiopic MSS. in the British Museum and the Bodleian Library; Herr Euting, Librarian of Strassburg, who has specially studied Phœnician inscriptions; Prof. Haug of Munich, whose particular branch of study is the Sanscrit, Zend, and Pehlvi languages; Prof. Krehl of Leipzig, an illustrious Arabic scholar; Prof. Lepsius of Berlin, an Egyptologist of universal repute; Prof. Nöldeke of Strassburg, who takes prominence for his knowledge of Arabic and Syriac and has lately published works on the modern language of Syria; Herr Pertsch, Librarian of Gotha; Prof. Roth of Tübingen, whose Sanscrit Lexicon of the University of St. Petersburg is perhaps the best work of its kind; Prof. Spiegel, famed for deep studies in the Zend-Avesta and languages of Persia; Herr Trumpp of Munich, privat-docent, and lately appointed Professor of Arabic and Persian, who has published many works in the language of Afghan, Sindhi, and Punjabi; Prof. Weber of Berlin, a Sanscrit authority of the new school; Prof. Weil and Prof. Windisch, both of Heidelberg, the former noted for Arabic learning, the other for Sanscrit and Celtic studies.

The programme of meetings is as follows:

Sept. 14.—Inaugural Meeting. With Address. 8.30 P.M., at the Royal Institution, 21, Albemarle Street. The meeting will commence with the election of the Council.

Sept. 15.—Semitic Section. President, Sir Henry Rawlinson, K.C.B. Secretary, W. S. Vaux, Esq., F.R.S. Sitting, 2.30 P.M., at the rooms of the Royal Society of Literature, 4, St. Martin's Place, Charing Cross.

Sept. 16.—Turanian Section. President, Sir Walter Elliot, K.C.S.I. Secretary, Prof. Douglas. Sitting, 8.30 P.M., at King's College, Strand.

Sept. 17.—Aryan Section. President, Prof. Max Müller. Secretary, Prof. Eggeling. Sitting, 2.30 P.M., at the Royal Institution, 21, Albemarle Street.

Sept. 17.—Hamitic Section. President, Dr. Birch, LL.D. Secretary, W. R. Cooper, Esq. Sitting, 8.30 P.M., at the rooms of the Society of Biblical Archæology, 9, Conduit Street.

Sept. 18.—Archæological Section. President, M. Grant Duff, Esq., M.P. Secretary, E. Thomas, Esq., F.R.S. Sitting, 11 A.M., at the rooms of the Royal Asiatic Society, 22, Albemarle Street.

Sept. 19.—Ethnological Section. President, Prof. Owen, C.B. Secretary, R. Cull, Esq., F.S.A. Sitting, 2.30 P.M., at the rooms of the Royal Asiatic Society, 22, Albemarle Street. At the close of the sitting the members of the Congress will decide in what country the next Congress shall be held, and will nominate the president.

There will be receptions on the following occasions:—

Sept. 15.—10 A.M., at the British Museum.

Sept. 16.—11 A.M. The Right Hon. Sir Bartle Frere will give a breakfast to the members of the Congress, at his residence, Wressil Lodge, Wimbledon.

Sept. 17.—10 A.M., at the India Office Library. 12 noon, at the Soane Museum.

Sept. 18.—Mr. Bosanquet will give an afternoon garden party to the members of the Congress, at his residence, Claymoor House, Enfield.

Sept. 19.—10 A.M., at the South Kensington Museum.

During the meeting of the Congress a Bureau will be opened at the Royal Asiatic Society's Rooms, 22, Albemarle Street, W., where every information concerning the Congress may be obtained.

The Committee of the Scientific Club have kindly invited the members of the Congress to make use of their club house, 7, Savile Row, W., during the session of the Congress. The foreign members of the Congress and their friends are invited by the Council of the Royal Botanic Society of London to visit the gardens of the Society, in Regent's Park, at any time during their stay in London. Such members will be admitted to the gardens by producing their cards of membership.

ANDERS JONAS ANGSTRÖM

ANDERS JONAS ANGSTRÖM, Professor of Physics in the University of Upsala, after a short illness of less than a fortnight, died, as we have already announced, on June 20, from an attack of inflammation of the brain. The death of Prof. Angström, who has been cut down in the full vigour of his powers and in the midst of a noble and active scientific career, is a loss to the entire world of science.

Angström was born Aug. 13, 1814, at the Lögdo Iron Works Settlement in Medelpad. He was the son of a pastor, who in the early childhood of Anders Jonas, removed to Ullanger, in Angermanland, and a few years afterwards to Sättna in the neighbourhood of Sandsvall, where he remained till his death in 1847. With no other means than the extremely limited stipend of a Swedish country minister, supplemented by the proceeds of a small glebe the elder Angström kept his three sons—the present Dr. Johan Angström and Prof. Anders Jonas and his young brother Carl Arendt at school, and even assisted them in their subsequent attendance at the University classes at Upsala. In these efforts the father was strenuously supported by his wife, without whose good management such efforts would have been impracticable; and to advanced age this admirable housewife continued to prosecute her daily task of spinning, without remitting her active supervision of her household.

Although circumstances compelled Angström to eke out the means necessary for his University course by his own exertions, he passed through all his requisite examinations with distinction and within the usual terms. After matriculating in the autumn of 1833, he took the degree of Doctor of Philosophy in 1839; became a physical tutor in the same year, and assistant in practical astronomy in 1843; while in the years 1846 and 1847 he fulfilled the duties of the Chair of Astronomy at the University, during the temporary absence on the continent of the professor. Owing to want of interest he had, however, five years to wait before he obtained any other fixed employment. The Chair of Physics had fallen vacant in 1839, the same year in which Angström graduated; but then, and for some time afterwards, his abilities were not fully recognised in the University, while with his natural modesty he abstained from presenting himself as a candidate, although he might then have enjoyed the same good fortune as his friend and fellow-student, Malmsten, who, after having had four years in which to prepare himself, was able on the death of the Professor of Mathematics, in the year 1843, to offer himself as a successful candidate for the vacant chair. At length, in 1858, on the public recommendation of the Consistory, Angström was nominated to the Chair of Physics, the duties of which he had performed for two years in the character of a *pro tempore* professor. This chair he continued to hold for the remaining sixteen years of his life.

During his occupancy of the chair Angström secured for the physical museum of the University an admirable collection of instruments for the determination of different exact measurements in the various departments of physical science; and as far as the limited resources at his disposal permitted, he improved the physical laboratories, and strove to awaken amongst the students an interest in the study of the exact sciences. He also continued for a number of years, in the capacity of Secretary to the Royal Society at Upsala, to conduct its transactions with a zeal and devotion which secured for him the grateful recognition of foreigners as well as of his own countrymen.

Although Angström published memoirs on almost all branches of physical science, his name will be for ever associated with the history of spectral analysis, for which he obtained from the Royal Society of London in 1870 the Rumford gold medal, a distinction which no Swede had ever before enjoyed.

In order to show Angström's place in scientific history in regard to this class of researches, it will be well in this place to briefly recapitulate the capital points.*

* This recapitulation is based upon the historical statement in Lockyer's "Solar Physics."

Fraunhofer, at the beginning of this century, pointed out the coincidence of place in the spectrum between certain dark lines which he saw in the spectrum of the sun and the bright lines in the spectrum of the flame of a lamp. In Dr. Brewster's note-book, dated St. Andrews, Oct. 28, 1841, this passage occurs :—"I have this evening discovered the remarkable fact that, in the combustion of nitre upon charcoal, there are definite bright rays corresponding to the double lines of A and B, and the group of lines *a* in the space A B. *The coincidence of two yellow rays with the two deficient ones at* D, *with the existence of definite bright rays in the nitre flame, not only at* D *but at* A, *a and* B, *is so extraordinary that it indicates some regular connection between the two classes of phenomena.*"

We next have an important experiment made by Foucault in 1849, who pointed out that the electric arc presented us with a medium which emits the rays D on its own account, and which at the same time absorbs them when they come from another quarter.

The received explanation of this coincidence between the two bright lines of burning sodium vapour, and the two dark lines D in the solar spectrum, which extended the grasp of spectrum analysis from terrestrial substances to the skies, was taught by Prof. Stokes in his lectures about 1852, but was not published.

In 1853 the idea was first published by Angström.*

In his memoir, for the purpose of illustrating the absorption of light, he made use of a principle already propounded by Euler, in his *Theoria lucis et caloris*, that the particles of a body, *in consequence of resonance*, absorb principally those ethereal undulatory motions which have previously been impressed upon them. He also endeavoured to show that *a body in a state of glowing heat emits just the same kinds of light and heat which it absorbs under the same circumstances.* He further undertook researches on the electric light, and stated that in many cases the Fraunhofer lines were an inversion of the bright lines, which he observed in the spectrum of various metals.

Early in 1859, Mr. Balfour Stewart independently discovered the law which binds together radiation and absorption, establishing it experimentally as an extension of Prévost's law of exchanges in the case of the heat rays, and generalising his conclusion for all rays.

In October of the same year, 1859, Kirchhoff established experimentally the same law for the light rays.

On the occasion of Angström's admission to the membership of the Royal Society, General Sabine in his introductory address mentioned that the obstacles opposed by the language in which Angström's treatise had been written, and by distance from the scene of his investigations, had for three years prevented its very existence from being known to the scientific world at large; but when once the nature of that treatise became known, the fact was immediately acknowledged, that in Professors Stokes and Angström we are bound to recognise the fathers of spectral analysis. Indeed, in the "Optiska Undersökningar" of the latter are to be found many of the fundamental principles of much that has since been accomplished in that department of scientific inquiry. In his work entitled "Recherches sur le spectre solaire," with its atlas of the normal spectrum of the sun, Angström has given us an indispensable adjunct for all future students of spectrum analytical investigations.

* "Optiska Undersokningar :" Trans. Royal Academy of Stockholm, 1853. Translated in Phil. Mag. 4th series, vol. ix. p. 237.

We have already stated that Angström published memoirs on subjects connected with nearly every department of physical inquiry. Thus we have papers :—(1) "Sur la polarisation rectiligne et la double réfraction des cristaux à trois axes obliques" (Upsala Vetenskaps-Societets Acta), in which he gives the solution of the problem involved in the optical phenomena presented by such crystals which had been sought, but without success, by Neumann and MacCullogh. (2) On the "Monoklinoedriska kristallernas molekulära Constanter" (Vet. Akad.'s Handlingar, 1859). (3) "Ny metod at bestämma kroppars ledningsförmaga för Värme"—New method of determining the capacity for conducting heat in the human body—(Vet. Akad. Förh. 1861) ; which contains the first determinations ever given of the absolute values of the capacity for conducting heat. (4) "Sur deux inégalités d'une grandeur remarquable dans les apparitions de la Comète de Halley" (Upsala Vet. Soc. Acta.). This treatise first excited the expectation amongst astronomers of obtaining certain results by means of a single method. (5) "Sur les Spectres des gas simples" (*Comptes Rendus*, 1871).

These are among the most important of Angström's numerous treatises, and in addition we may instance his celebrated monograph, "Mémoire sur la temperature de la terre" (Upsala Vet. Soc.'s Acta.), as well as a paper belonging to an earlier period, which appeared in the "Denkschriften der Münchener Academie," 1844, under the title of "Magnetische Beobachtungen bei Gelegenheit einer Reise nach Deutschland und Frankreich."

As might naturally be expected, numerous scientific Societies sought the honour of numbering Angström amongst their members, as for instance :—Kungl. Vet. Akad. i. Stockholm ; Kungl. Vet. Akad. i. Upsala ; the Royal Societies of Berlin, Copenhagen, London, &c. He was, moreover, appointed Corresponding Member of the French Institute ; he twice obtained the Wallmarsk prize of the Vet. Akad. of Stockholm in 1865, in conjunction with Professors Thalén and H. Holmgren, and in 1869 with the former alone. He carried off two other prizes given by the same Society, and once he obtained a grant of money for his observations from the University of Upsala, before he had become a member of the Upsala Vet. Soc., which was the more acceptable to him, since for a long period he reaped a very inadequate pecuniary return for his scientific labours. Partly by the aid of the State, but mostly at his own personal expense, Angström several times visited the Continent, especially France and Germany. He was absent from Sweden in the years 1843, 1844, 1859, and during the summers of 1866 and 1867 ; but with one exception he attended all the meetings of the Scandinavian Association for Natural and Physical History. In recognition of his great merits, Angström was made Knight of the "Order of the North," and Commander of the Vasa Order 1st Class, and of the "Crown of Italy."

THE IRON AND STEEL INSTITUTE

THIS prosperous and useful association held its sixth summer meeting last week, from the 1st to the 4th instant, at Barrow-in-Furness, a town whose rapidity of growth is unparalleled out of America. Twenty-five years ago the village of Barrow, near the southern extremity of the peninsula of Furness, in Lancashire, had a population of barely 200; now the municipal borough extends over an area of about 15,000 acres, with a population of about 35,000. Even fourteen years ago, when the first volume of *Chambers' Encyclopædia* was published, it seems to have been so little known, or of so little importance, as not to find a place in that useful work. It is now a well-laid-out town, with fine docks, and some of the most important iron and engineering works in the kingdom; while one of the steel works are considered to occupy a leading position in connection with the manufacture of Bessemer steel. This unequalled growth of the town of Barrow is entirely owing to the rapid development of the various industries connected with iron, the mineral deposits of the district being unusually rich.

Such a town forms an appropriate meeting-place for an Institute which has done so much to develop the manufacture of iron and steel, by affording a medium for the interchange of ideas between those who are engaged in the practical work of these industries or in the investigation of the scientific principles on which they must be founded if they are to be successful. The Institute is to be congratulated on the scientific tone which has all along pervaded its proceedings and its publications since it was founded in 1869. Though it has had such a comparatively short existence, it seems to have been in all respects prosperous (it now numbers close on 600 members), and to have most satisfactorily fulfilled the purpose for which it was instituted, the improvement of the all-important manufacture of iron and steel by the free interchange of ideas generated by experience or scientific study. To quote the words of our contemporary *Iron*: "Anterior to the establishment of this important society, the manufacturers of iron in its various forms had scant opportunity of communicating in public the results of their own experience, and of comparing those results with the observations of other persons equally interested in their development. Various methods of working prevailed in different parts of the country, and not long ago many processes connected with iron and steel manufacture were regarded as trade secrets to be carefully treasured up and jealously guarded. To the abolition of these narrow and antiquated notions the Iron and Steel Institute addressed itself vigorously from its very inception. It soon became apparent that among the first promoters of the society there prevailed an earnest desire to cast aside all petty jealousy, and to add unreservedly their individual knowledge to the general stock of information. Adherence to this excellent principle produced a prompt effect on the minds of iron and steel makers in all parts of the British Empire, and secured the sympathy of continental and American manufacturers." This is a very valuable result to have been accomplished in so short a time, and may perhaps partly be accounted for by the high scientific character of those who have from the first been elected to hold office in the society. With such names on its list of office-bearers as his Grace the Duke of Devonshire, Mr. Isaac Lowthian Bell, F.R.S., Mr. Bessemer, Mr. John Jones, F.G.S. (general secretary), Mr. David Forbes, F.R.S. (foreign secretary), Dr. C. W. Siemens, F.R.S., and others, the Institute has every chance of doing good work and of imbuing its members with a feeling of the necessity, in order to secure the highest success in their important industry, of importing into it continually the results of the latest and highest scientific research. There is little fear of the practical side of the iron and steel manufacture being neglected; and if this as well as other similar Institutes, do their work faithfully, and if the members enter upon their work equipped with a thorough scientific as well as professional training, there will be little fear of other nations outstripping us in this, as they threaten to do in other industries. To keep up the tone of the Institute, the importance of electing right men to hold office in it cannot be too much insisted on, and we hope that in this respect it will go on as it has begun.

The Barrow meeting seems to have been a real success; the only complaint being, as is almost always the case at such meetings, the difficulty of getting sleeping accommodation for the members; in Barrow this is not to be wondered at, as the people have scarcely had time yet to think about building hotels. The Duke of Devonshire, who is intimately connected with Barrow, the Earl of Lonsdale, the Mayor, and other dignitaries, as well as the railway companies and proprietors of the numerous works in and around Barrow, entertained the members most hospitably, and gave them every opportunity of inspecting the working of the numerous vast establishments connected with the industries with which the Institute is concerned. Indeed, the greater part of the four days seems to have been spent in visits and excursions; and considering the nature and aims of the Institute, its time could not, perhaps, have been more profitably spent. A good many papers were also read, all of them of considerable practical value, but of too purely technical a nature for these columns. Among the more generally scientific we may mention Mr. Wurzburger's very interesting and well-informed paper on the Geology of the West Coast Iron Ore Districts, and Mr. Charles Smith's paper on the Iron Ores of Sweden. The last day, September 4, was entirely devoted to an inspection of various mining works in the West Cumberland district.

Altogether we have no doubt that the members of the Institute will look back upon the Barrow meeting as one of the pleasantest and most instructive they have had. The Right Hon. Earl Granville has been elected president for the years 1874-6.

SHARPE'S "BIRDS IN THE BRITISH MUSEUM"

Catalogue of the Birds in the British Museum. Vol. I.—Accipitres. By R. Bowdler Sharpe. (Printed by order of the Trustees.)

THE great value of Dr. Günther's "Catalogue of Fishes" in the British Museum is appreciated by all working zoologists; and when Mr. Sharpe was appointed one of the Senior Assistants in the Natural History Department of that noble institution, ornithologists had every reason to hope for an equally important work on the birds in the same collection, all fully realising Mr. Sharpe's perfect competency for the execution of so arduous a task. The volume before us shows that their hopes were not misplaced. The "Hand-List of Birds," by the late Mr. G. R. Gray, invaluable as it is on account of its extensive indexes and easy method of reference, has a very definite and narrow limit of utility; it is an essential supplement to a library, but gives no detailed information itself. The work before us has a very different scope. Besides the nomenclature and the synonomy of the whole bird-class, it will contain the complete description of each species from the hand of one of our most able and enthusiastic ornithologists, based upon the finest collection in the world, the deficiencies of which, through the liberality of the trustees and the energy of its superintendent, are being so rapidly diminished, that, as we are told in the introduction, of the 354 certain species of diurnal birds of prey at present known, less than thirty are desiderata in the collection. Woodcuts, scattered through the volume, help to illustrate many of the peculiarities of the heads, tarsi, and toes of the species to which they refer; whilst twenty or so coloured plates, from the pencil of Mr. Keulemanns, assist in indicating the special characters of type-specimens and rare forms.

A glance through the work tends strongly to confirm our prejudice against the existing rules of avian nomenclature, and makes us hope that before long some improvement in the direction of simplification will be adopted. The system of Linnæus was a binominal one, no doubt; but though that at present in vogue still retains that name, it has gradually drifted into a quadrinominal system. The number of species of birds is certainly large, but hardly beyond the grasp of a binominal nomenclature. As it is, each bird receives its two Latin names, generic and specific, added to which is that of the author who originally described it as such, in brackets or not, according to whether he placed it in some other genus or in the one in which it is retained. Could not some universal congress be formed to determine once for all a name for each species, based on the laws of priority, present knowledge, and euphony, and so fix the appellation of all now known birds, as a starting-point for future workers, so that it need no longer be felt that the publication of every new book which has any pretension to sound work will bring with it changes in the naming of even our most familiar species, which are as confusing as they are unimportant? In the work before us the well-known smallest of the diurnal birds of prey is shown to have to be placed in a new genus, *Microhierax*, instead of retaining its habitual name *Hierax*, whilst the King Condor must in future be *Cathartes* instead of *Gyparchus*, the Black Buzzard changing to *Catharistes* or *Catharista*, according to the appreciation of gender in the author transcribing it.

The Turkey Buzzard fares still worse. Its generic distinctness from the last-mentioned bird must have struck Mr. Ridgeway in the United States and Mr. Sharpe in this country almost simultaneously. Both authors must have had the works in which they announce their proposed change in proof at the same time. The "History of North American Birds," however, appeared shortly before the volume under present review, and consequently the still-born *Œnops* has to sink into a synonym of *Rhinogryphus*. A similar fate has awaited *Urubitinga uricincta*, which will have to stand as *Antenor* instead of *Erythrocnema*. Among other fresh genera we find *Lophotriorchis*, which includes *Spizaëtus kieneri* and *S. isidorii*; and *Urotriorchis*, containing only *Astur macrurus*; and others. With regard to species, Mr. Sharpe has separated off the smaller brown Condor as *S. aequatorialis*; the Turkey Buzzard, with yellow head and white irides, as *R. pernigra*; an *Astur*, obtained by Mr. Wallace in Lombock and Bouru, as *A. wallacii*; and a Falcon, which Prince Bonaparte and Prof. Schlegel consider a melanism of *F. severus*, as *F. religiosus*.

Next with regard to the classification which is adopted; as the work does not profess to be more than a catalogue and a key for the identification of the species, it would not be fair to expect that in the separation of the different families and genera described all the known peculiarities should be given; sufficient for the ready identification of each being all that is required. Consequently when the sub-family *Polyborinæ* of the family *Falconidæ* is divided up as in the following table, without any further definition, it is evident that the author only attempts to give a minimum, and not a maximum number of distinguishing features.

POLYBORINÆ.

Key to the Genera.

a. Middle tail-feathers not elongated.
- *a'* Nostrils oval. — POLYBORUS.
- *b'* Nostrils round — IBICTER.

b. Middle tail-feathers extremely elongated; head with elongated plumes.
- *a'* Nostrils vertical ovals; forehead with erect crest — CARIAMA.
- *b'* Nostrils perpendicular ovals; forehead not crested — SERPENTARIUS.

In the above instance we are astonished, as many others will no doubt be, not so much at the slightness of the differentiation of the genera, as at the fact that *Cariama* and *Serpentarius* are placed in such intimate relation with the Caracaras. The illustrious Nitzsch, whose opinions on classification are more to be relied on than those of any other zoologist, it is true, placed the Secretary Bird with the Accipitres, though he retained the Cariama with the Bustards. More recently there has been a tendency, which is daily becoming stronger, to combine the one with the other. The question then arises, are they Bustards or are they birds of prey? Internal structure is overpoweringly in favour of the former position; and such being the case, it is almost to be regretted that no further notice has been taken by Mr. Sharpe of their peculiarities than the statement that in two out of the four genera of the Polyborinæ, the median tail feathers are elongate, whilst in the other two they are short, especially when *Pandion* is placed in a sub-order by itself; and, as it happens, has its foot accidentally represented without the ungual phalanges or any of the three anterior toes. For though *Serpentarius* presents strongly marked external facial resemblances to *Polyborus*, which, by the way, are not to be found in *Cariama*, nevertheless in other respects they both differ so much from all other true Accipitres, that it would be impossible, even if they were birds of prey, to do otherwise than place them in a sub-order by themselves; which is the same thing as saying that their relationship to the Caracaras is not more intimate than to the eagles and the hawks.

Similarly, the American Vultures, or *Cathartidæ*, if they are vultures at all, which is extremely improbable, can hardly be included in the same family with their typically accipitrine namesakes, but must be placed independently by themselves. The conformation of the feet alone, and more especially the difference in the proportionate length of the phalanges pointed out by Prof. Huxley, is alone sufficient to decide this point.

Leaving these minor points out of the question, however, as having little or no bearing on the true value of the whole, we look on the volume before us as the precursor of others, which if all completed in the same thorough and able manner that is throughout manifested in the first, will form a standard ornithological work, the importance of which it will be impossible to overestimate. We wish Mr. Sharpe all success in the further prosecution of his almost herculean task.

OUR BOOK SHELF

1. *The Principal Timber Trees.* 2. *Select Plants (exclusive of timber trees).* 3. *Additions to the Lists of the principal Timber Trees and other Select Plants readily eligible for Victorian Industrial Culture.* By Baron Ferd. von Mueller. (Melbourne)

THESE papers, drawn up by Baron Mueller, and first published in the Proceedings of the Zoological and Acclimatisation Society of Victoria, are something more than mere lists, inasmuch as in their separate pamphlet form, in which form they have all since been issued, the first occupies 58 pp. 8vo, and was issued in 1871; the second, 428 pp. 8vo, issued in 1872; and the third, the "Additions," 40 pp. 8vo, issued only a month or two since, and only just come to hand.

It is not on account of any original observation being made into the properties or uses of the trees or plants enumerated that we think these papers worthy of notice, but rather on account of their practical use in imparting to an unscientific colonist a knowledge, not only of such trees and other plants as may grow in the climate, but also of their value in an economic or commercial point of view. By means of a pamphlet like either of the above, we have ready references to plants, natives of nearly every part of the globe, which are, moreover, with some authority considered suitable for acclimatisation in Australia and other countries. Such information as the geographical distribution, habit of the plant, &c., could only be obtained by reference to the numerous Floras and bulky botanical works which are as sealed books to the colonists generally, while the economic applications would have to be sought for in numerous other and totally distinct works, for our Colonial Floras seldom or never even touch on this important part of the subject. Baron Mueller, indeed, says that these lists are intended not so much to contain records of original research as "to bring together information more condensed and more recent than would be attainable in costly or voluminous works of even several languages."

The arrangement of the genera is alphabetical instead of being scientific, and the following examples will show the sort of information given :—

"*Buxus sempervirens* L.—The Turkey Box Tree. South Europe, North Africa, South-west Asia. This slow-growing tree should be timely planted to provide the indispensable box wood for wood-engravers and musical instrument makers, as yet no good substitute for it having been discovered. The box tree needs calcareous soil for its best development. Among allied species, *B. balearica* attains a height of eighty feet."

Then follows a list of other species of *Buxus*, about which, however, little is known as to the value of the respective woods. Here is another example, taken haphazard :—

"*Guevina avellana* Molina.—Extends from Middle Chili to the Chonos Archipelago. Briefly alluded to already in the list of trees desirable for Victorian forest culture. One of the most beautiful trees in existence. The snowy white flower-spikes produced simultaneously with the ripening of the coral-red fruit. In the cooler southern regions the tree attains considerable dimensions. The wood, tough and elastic, used for boat-building. The fruit of the allied *Brabejum stellatifolium* can only be utilised with caution in a roasted state as an article of diet, because it is noxious, or even absolutely poisonous, in a raw state."

Guevina avellana is a Proteaceous tree, the fruits of which are very similar in appearance, and the seeds very similar in flavour, to those of the Australian tree *Macadamia ternifolia*. These lists will probably prove useful not only as a guide to the selection of plants for the purposes of acclimatisation, but also as a handy reference for economic species generally. J R. J.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. No notice is taken of anonymous communications.*]

A Remarkable Thunderstorm

[The following letter has been forwarded to us for publication by Mr. R. H. Scott, F.R.S.—ED.]

"Yorkshire Philosophical Society,
York, Sept. 2, 1874.

"Dear Sir,—I have to report to-day one of the most unusual thunderstorms that I ever remember. It began to be dark about 12.30 noon, and rain fell; at 12.40 it was much darker; at 12.43 rain fell in torrents, but was so much driven by the wind that you saw it being driven like snow in packs; so dense was it now and for ten minutes that I could not see chimney-pots 100 yards distant. The thermometer must have fallen tremendously, for windows were so steamed inside as to be opaque. I remarked that the clouds went in the direction of N.W., while the wind was S.S.W., and force about 8. Part of the time it went in whirlpools, as it were; during the climax of ten minutes we had rain with lightning and thunder, then snow, and snow and sleet, and distinct hail afterwards, but not of large size.

"I should have taken the state of the instruments, but I was about half a mile from the museum.—I am, &c.,

(Signed) "C. WAKEFIELD

"R. H. Scott, Esq., F.R.S.,
"Director, Meteorological Office.

"P.S.—Rain measures ·49. There was lightning (a little forked, the rest sheet) and thunder during all the storm."

The Exhibition of Specimens and Apparatus at the British Association

IF no one else has already done so, will you permit me to call attention to the valuable feature of the Belfast meeting of the British Association presented by the exhibition of specimens, apparatus, and diagrams in the Anatomical Museum, due, it is understood, to the energy and perseverance of Mr. Ray Lankester. Here were to be seen, for instance, Mr. Symons's series of thermometers illustrating variations in sensibility, a collection of bones and other remains found in Kent's Hole and the Victoria Cave, during 1873-74, Dr. Pye Smith's large undescribed Medusa, the diagrams and plants which illustrated Dr. Hooker's address on Carnivorous Plants, specimens of breech-loading fire-arms, and many other objects of interest, all catalogued in each day's issue of the "Journal." It is to be hoped that a similar collection, rendered still more complete through the co-operation of the authors of papers, will be an addition to the attractions of all future meetings of the Association.

Penmaenmawr, Sept. 4 ALFRED W. BENNETT

Photographic Irradiation

IN NATURE, vol. x. p. 245, Mr. W. C. Crofts adds his experience to those previously given in your journal, and gives his conclusion as opposed to that of Mr. Aitken (vol. x. p. 185). Like most conclusions based on incomplete evidence, it does not conclude anything. The fact is as I have stated it in my previous note (vol. x. p. 205) on the subject, and when I return to England I will be most happy to demonstrate it to anyone who cares to examine the question thoroughly. Mr. Crofts' experience with the Liverpool dry plates agrees with my own, for these plates are prepared with a pyroxyline which gives a minimum of irradiation when "backed," and give the best quality of image for scientific purposes attainable with a bromide film; but certain qualities of pyroxyline prepared in precisely the same way will show irradiation that nothing can cure, even when used for making transparencies by contact, where, of course, there can be no question of influence of any optical defects. The unquestionable fact that a collodio-albumen film acts in so totally different a manner from one of bromized collodion should prove that the lens has next to nothing to do with it.

My conclusions may be very imperfect, but so far as they go they are definite, and are drawn, not from two or three, but from hundreds of experiments with all kinds of dry plates and many different samples of pyroxyline, and whatever they may be worth, they fully support Mr. Aitken's views.

New York, Aug. 19 W. J. STILLMAN.

Pfluger on the "Salivary Glands" of the Cockroach

I WAS much interested in reading Prof. Redfern's able address at the British Association this year, more especially with that portion which dealt with the observations of Prof. Pflüger on the histology of the so-called "salivary glands" of the cockroach. In the year 1871 I wrote a short paper in Professors Humphry and Turner's Journal (vol. v. p. 242 *et seq.*) upon these organs. In this I ventured to doubt the truth of the generally accepted hypothesis as to their functions. My reasons for so doing may be summarised as follows:—1. The appendages in question are perforated throughout by ramifying spirally coated tubules differing only from tracheæ in this respect; during their passage through the organs in question they receive a layer externally of yellowish tissue, which may be, as Prof. Pflüger suggests, epithelial glandular tissue. 2. These tubules with the sacculi opening into them can be more or less fully injected with a liquid by simply immersing the insect in a suitable menstruum, and placing it under the exhausting receiver of an air-pump. This experiment demonstrates indubitably that this tubular system contains an *elastic fluid*, which for anatomical and other reasons I conclude to be air. 3. As far as my experience carried me, the sacculi, the supposed reservoirs of the saliva, never contained naturally any liquid whatever, but upon opening the thorax were invariably found to be collapsed and apparently empty. This is precisely what would occur supposing that during life they were filled by and communicated readily with the external air.

I have not yet had an opportunity of referring to Prof. Pflüger's paper, and I am consequently obliged to accept his statements at second hand. In noticing the intimate connection there is between these organs and the nervous system of the insect, he confirms what I have myself observed. It is some years since I last anatomised a cockroach, and meanwhile I suppose these insects have utilised their organs in the way mentioned by Prof. Pflüger, and we can now see "transparent drops transuding from the ends of cells when the saliva has been made to flow by irritation of the gland." On looking over my microscopic specimens I find that I still have by me one showing the so-called "salivary duct" and a sacculus injected in the way I have mentioned. Any one may satisfy himself that this result is feasible by trying the experiment. In doing so the only caution required is to exhaust the air gradually and to keep the immersed insect in a partial vacuum for a few hours. Failure under these circumstances is almost impossible.

London, Sept. 2 W. AINSLIE HOLLIS

THE CONFERENCE FOR MARITIME METEOROLOGY

THE Conference, held at the Meteorological Office, 116, Victoria Street, for the purpose of reconsidering the decisions regarding maritime meteorology made at the Brussels Conference in 1853, has concluded its sittings, and the Report of its proceedings will be presented to the Permanent Committee, appointed by the Meteorological Congress of Vienna (of 1873), which holds its meeting at Utrecht in the course of the present week. The Conference consisted of twenty-five members, belonging respectively to every maritime country of consequence in Europe, except Sweden and Turkey. India and China were also represented. Prof. Buys Ballot was elected president, and Capt. Hoffmeyer and Mr. Scott, F.R.S., secretaries. It met on the 31st ult., and at once subdivided itself into two sub-committees, dealing with the various questions connected with (1) "Observations," and (2) "Discussions." Each sub-committee held four sittings, and at the closing meeting of the Conference the several resolutions framed by the sub-committees were adopted, in most cases unanimously. Inasmuch as the Conference was an outcome of the Vienna Congress, these resolutions will not be published until they have been communicated to the Permanent Committee as above mentioned. Their general scope is towards the attainment of greater uniformity in the methods of meteorological observation at sea, and of subsequent publication of the results. On Thursday, by kind permission of the Astronomer-Royal, the members went to Greenwich in the morning, where they were conducted over the magnetical and meteorological department by Mr. J. Glaisher, F.R.S. In the afternoon they spent some hours at Kew Observatory, where they were received by Mr. Jeffery, the superintendent, and in the evening the whole party was entertained at dinner at the Star and Garter, by some of the members of the Meteorological Committee. On Friday several members availed themselves of the great courtesy of the War Office, and repaired to Woolwich, where they were conducted over the Arsenal by Colonel Field and other officers connected with that department. Finally, on Saturday, they inspected the Meteorological Office, where the meetings of the Conference had been held, and paid special attention to the arrangements there existing for reproducing the records of the photographic and other instruments at the several observatories in the United Kingdom.

ON SEWAGE AND SEWAGE FARMING

No. 1.—*Northampton.*

AFTER having had practical experience of the fertilising effects of sewage and liquid manure, I have for several years devoted part of my leisure time to an examination of the arrangements adopted by the principal cities and towns for disposing of sewage. At first I looked at it from the agricultural stand-point; but as I proceeded with the inquiry I had to widen the range of view.

The place I visited last is Northampton. I propose at present to write a concise note of what the authorities of that town have done.

Northampton has a Board of Commissioners for dealing with sewage and kindred nuisances, which is distinct from the corporation. I believe their number is limited to twelve; of whom six belong to one political body, and six to the other. These twelve Commissioners, as a body, must, therefore, be non-political: six of one being equal to half-a dozen of another.

The town contains at present about 50,000 people. Many experiments were made at the expense of this body for purifying the sewage. At last they adopted the scheme which I proceed to describe.

Near the town there is a number of tanks in which the sewage is allowed to settle for some time so as to enable the more bulky of its solid contents to fall to the bottom and be collected. Deprived of these solid matters, the sewage is conveyed in a main culvert, about four miles from the town, where it is received on a tract of ground containing upwards of 300 acres, which was purchased at a cost of 130*l.* an acre. I may mention that all the figures were obligingly communicated to me, verbally, by the chief officer of the Commissioners. Up to the present the outlay has amounted to upwards of 84,000*l.* The soil is not naturally the best adapted for sewage-farming; it does not, however, offer any insuperable obstacle to success. The sewage is received at the highest point of the farm, from which it flows by gravitation to the lowest, which is several feet below the river that runs by, and into which the sewage passes after it has undergone clarification.

The sewage is distributed over the farm by a simple system of carriers, and it is used mainly for irrigation. After it goes over one plot it flows to another, and so onwards. At the lowest part of the farm a permanent plot of osiers has been planted; the intention being that this plot will serve as a filter-bed for abstracting from the sewage all offending material which is not taken out by irrigation. After percolating through the soil of this osier-bed, the clarified sewage is received in a second, or outlet culvert, which is about two miles long, and in which the fall—one foot per mile—is less than that of the river.

Under cultivated crops of all kinds at the present time, there are about 100 acres. There is one good plot or field of Italian rye-grass; one good, and one indifferent plot of mangold wurzel; and one good plot of beans. A large field of Italian rye-grass has utterly failed, and in its place grew a luxuriant crop of weeds, which would have proved an attractive feature in a botanic garden. There are other failures on which it is useless to dwell.

The land is not farmed in what could be called a skilful manner; indeed, the engineer frankly said that up to the present, farming had been a secondary object with the Commissioners.

The greater part of the uncropped land has been recently purchased. It is now being prepared for the sewage at a cost which will doubtless exceed 20*l.* an acre. I cannot help thinking that a simpler scheme would answer equally well for irrigation.

It will be understood at once that the inhabitants of Northampton have been rid of the abominable stench which the sewage formerly inflicted on them. But there remain for consideration two points of very great importance to the people who live along the river below the sewage farm. In the first place, if the sewage be not deprived of its organic impurities on the farm, it must, on mixing again with the river, cause a fresh nuisance. That the people do think so is evidenced in a newspaper report which lies before me; and judging from what I saw of the effluent water, I can sympathise with these people. I took a small bottle of this water, which I find contains a large quantity of organic matter. As it went on the osier-bed it was still sewage most unmistakeably; and when the pores of this bed—this so-called filter bed—become full of the organic impurities, as they soon must, the complaints will become louder and louder, and justly so.

I have a second objection to the arrangements here adopted, and it is this: What guarantee is there that the *contagium* of any infectious disease which may be in the sewage is destroyed? That *some* of it would be oxidised or destroyed in flowing over the ground is certain; but the necessities of the case require that the whole of it should be destroyed. I have made experiments which prove conclusively that the contagium of infectious cattle diseases is not destroyed in flowing over land, nor in passing through such a filter as is here provided; and as there is no evidence to show that the contagious principle of human infectious diseases is not equally active, it cannot be said that the Commissioners of Northampton have satisfactorily disposed of the sewage of that town.

THOMAS BALDWIN

NOTES

WE take the following from the New York *Nation* of Aug. 20:—"The American Association for the Advancement of Science has held its annual meeting at Hartford during the past and present week. The most important business before the meeting has been the consideration and adoption of a new constitution, designed to remedy a long-continued evil growing out of the popular character of the Association. The scientific character of the papers and proceedings has very frequently been such as seriously to compromise the standing of the Association in the scientific world. To remedy this, it has been decided to select from the members those who are engaged in science and form them into a separate class of 'Fellows.' All the officers of the Association are now to be chosen from this class, and the power of the several committees to exclude improper or unsuitable communications has been increased. All friends of science will await with interest the working of this improvement. The necessity of some vigorous and effective measures must be obvious to any one who will simply examine the lists of papers presented for reading. Among some hundred authors, the number of really eminent men may be counted on one's fingers, while the large majority are entirely unknown, and present papers which, so far as can be judged from their titles, are of no scientific importance. We greatly doubt whether this evil will be cured by anything short of a radical change in the publishing system of the Association. So long as there is a volume of 'Proceedings' to be published, so long will there be a pressure on the part of the less desirable class of members to have their papers printed, and this pressure can be resisted only by a little more moral courage on the part of the Standing Committee than it has hitherto exhibited. While such papers are admitted, we may be sure that few of the abler members will wish their productions to be seen in such company. It is gratifying to notice that the present meeting exhibits a decided improvement in this respect, and that notwithstanding the general unimportance of the communications, the subjects of ether and atoms do not appear among those discussed before the Association."

UNDER the Principalship of Monsignor Capel, a Catholic College is shortly to be opened in Kensington, in which the Natural Sciences will be taught without restrictions. A museum, a laboratory, and lecture rooms are in readiness; and in the Educational department more than one appointment has already been made. Mr. St. George Mivart is to lecture on zoology during the winter months, and on botany in the summer. Mr. Barff is to lecture on chemistry. From what we hear, it will not be for lack of means that this institution will not be successful.

AMONGST those who will probably be candidates for the professorship of Zoology and Comparative Anatomy, now vacant in University College, London, are Mr. E. Ray Lankester, Dr. J. Murie, and Mr. H. Seeley.

DR. ALLEYNE NICHOLSON has been appointed to the chair of Biology and Physiology about to be established in the Durham University Colleges of Medicine and Physical Science, Newcastle-on-Tyne.

ON the 3rd inst. the Bishop of Exeter laid the foundation-stone of a high-class school, to be conducted under the provisions of the Endowed Schools Act, at Newcastle-under-Lyne. His lordship dwelt chiefly on the advantages of a modern education, embracing chemistry, mineralogy, and mathematics, as compared with the old Latin and Greek system. He congratulated the borough upon doing the most important work that not only the district, but the whole of England could be engaged in, by establishing a school in which boys might not only be taught a little Latin and less Greek, but might be taught modern languages and natural science, so as to fit them for the future occupations of life.

In this connection we would refer to Sir Charles Reed's statement, on Tuesday night, at the Radnor Street Schools, City Road. "With respect to scientific education," he said, "this country is far behind other countries; and in that she has fallen back, as she has also in manufactures and in trade, and is letting such countries as America and Germany run far ahead of her. More attention must be paid in all our schools to the scientific education of children."

The Duke of Bedford has just sent 100*l.* for aiding in the establishment of the Artisans' Institute for Promoting General and Technical Knowledge, to the Rev. H. Solly, who is to be its first principal. Mr. Samuel Morley, M.P. (who is one of the trustees in conjunction with Lord Lyttelton and Mr. Hodgson Pratt), has also given 100*l.*, besides guaranteeing 100*l.* a year for three years. These, with smaller contributions from a number of other friends, have enabled the trustees to take premises in Upper St. Martin's Lane, which will be well adapted for the purpose when considerable alterations have been made in them. The object of the Institute appears to be to exemplify in a central locality, and in a special instance, those plans for the general and technical instruction of the working classes which so many of them now desire to see carried into effect, and which Mr. Solly aimed at promoting on a national scale by the formation of the "Trades Guild of Learning." Pending the satisfactory establishment and full development of the larger organisation, it is hoped that the proposed Artisans' Institute will, both directly and indirectly, give a considerable impulse to the higher as well as technical education of the skilled workmen of the metropolis, as many of their leading men have publicly signified their cordial approval of the project; and the desire for increased culture is rapidly increasing among that important and intelligent class. It is expected that the Institute will be ready to open early in October. Donations in aid of it will be thankfully received, and may be paid to the account of Mr. Hodgson Pratt, treasurer *pro tem.*, at the London and Westminster Bank, 217, Strand.

An enthusiastic meeting was held in Bombay on the 1st of August, at which a committee was appointed for the purpose of raising a fund by public subscription for a memorial to the late Dr. Bhau Dajee, of whom we gave some account in a recent number.

The Government of India, says the *Bombay Gazette*, has determined to perpetuate the memory of Dr. Stoliczka, the distinguished naturalist, who met his death on the return journey from Yarkand, by erecting, at the public expense, a tomb over his remains at Leh, and a tablet in the new Indian Museum at Calcutta.

The death is announced of Sir John Rennie, C.E., F.R.S., the eminent civil engineer, under whose direction some of the most important engineering works of the past half-century have been carried out. Sir John, who died on Thursday last at Bengeo, in Hertfordshire, was born in 1794, and was the son of the late Mr. John Rennie, who designed new London Bridge, and who also designed and executed Southwark and Waterloo Bridges. Mr. Rennie educated his son for his own profession, and left to him the task of executing his designs for London Bridge. On its completion and opening in 1831 Mr. Rennie received the honour of knighthood. Several foreign distinctions had been conferred upon him.

Our readers will be glad to hear of the safety of the members of the Austrian Payer and Weyprecht Arctic Expedition, who have been out for two years, and who, it was feared, had come to grief. A *Times* telegram, dated Christiania, Sept. 5, gives a brief history of the expedition. They left Tromsö in the *Tegethoff* on the 14th of July, 1872. They encountered compact drift ice in 48° E. long., and worked themselves through until, in 58° E. long., they reached the coast of Novaya Zemlya, under the Admiralty Peninsula. They sailed along the coast to Berch Islands, where they met Count Wiltczek's sloop *Isbjörn*. They sailed together with him further to Barents Islands, near the promontory of Cape Nassau, where they remained at anchor till the 21st of August, 1872, on account of south-westerly storms. There a depôt of provisions was established. They parted with Count Wiltczek and steered north-east the same day, and were completely frozen in. They drifted with the pack ice fourteen months, first north-east to 73° E. long., and then north-west until October 1873. In August 1873 a new land was discovered. They drifted with the ice along this land. They were frozen in, and wintered in 79° 51′ N. lat. and 59° E. long. In March and April 1874 sledge expeditions were sent north and west; 82° N. lat. was passed, and land was seen to the 83rd degree. The extent of the land northwards and westwards was, apparently, considerable. The ship, now being untenable, was abandoned. Starting on the 20th of May, 1874, with four sledge boats, they met the open water on the 15th of August, and crossed to Novaya Zemlya, and went along the coast in search of vessels. They met a Russian schooner on the 24th of August in Puchowa Bay, and arrived at Vardoe, in Norway, on the 3rd of September. The health of the crew was excellent. Engineer Krisch died in March 1874 from tuberculous disease. Large mountain ridges are said to have been observed in the newly discovered land, but no signs of animal life; and immense glaciers were met with.

The loss is announced of the whaler *Arctic*, of Dundee, at Davis's Straits. The *Arctic* at the time she was lost was full. She was commanded by Capt. Adams, with whom, it will be remembered, Capt. Markham, R.N., of the *Sultan*, made a voyage of investigation a year ago. Capt. Adams had distinguished himself by the surveys which he made of several of the Arctic coasts. All hands have been saved.

The Berlin African Exploration Society is fitting out a second expedition to the interior of Africa. Herr Alexander von Hormayer, the well-known ornithologist, will be the leader of the expedition, and will go from St. Paul de Loanda by way of Kassimbe to Moatta Jambe.

The British Bee-keepers' Association, founded in May last, has been fortunate in securing Sir John Lubbock as its President, and though the members number but little over 120, they have already shown a commendable earnestness. On Tuesday they held, at the Crystal Palace, their first show of bees, hives, honey, and accessory apparatus; and during the day some of the bee masters manipulated their hives, showing how to take honey, introduce queens, and to do other necessary work usually supposed to be accompanied with some danger. The primary object of the Association is to promote the more extensive cultivation of bees, especially by cottagers, and the study of the best way of obtaining most honey with the least waste. The American "Slinger" was shown in operation, and effectually drives out by centrifugal force all honey from a comb without injuring the By the application of this principle much of the time that would be occupied in making cells is saved, and bees at once begin refilling the comb. A secondary object of the Association is to promote the study of the habits and powers of bees, and special prizes were offered for observatory hives. Now that Sir John Lubbock has led the way in showing how to observe individual bees (see Nature, March 26), we may expect that many people will be induced to take up such an interesting subject and add to our stock of knowledge. Almost everything about the powers of bees has yet to be learned. An observatory hive stocked with bees costs, we believe, only about thirty shillings, and the *British Bee Journal* is always willing to give any information to inquirers needing instruction. The last number that has been forwarded to us, and besides giving a great deal of practical instruction, contains an interesting article on the Philosophy of Hive Shape.

THE Southport (Lancashire) Aquarium will be opened on the 16th inst.

AMONG the newly enrolled members of the Victoria Institute is M. Joachim Barrande, the Bohemian palæontologist.

A TELEGRAM from Rome of Sept. 5 announces that the eruption of Mount Etna has ceased, but that the shocks of earthquake continue.

THE *Melbourne Argus* has the following among its news from the South Sea Islands :— "On the 30th of April Captain M'Kenzie observed what he believed was a submarine volcano in a state of activity. When about midway between Haabai and Tonga, two of the Society Islands, about 12 miles from land, he observed a large column of water shoot up fully 100 feet into the air. There was a dense cloud of what appeared to be steam rising from the ejected water. Captain M'Kenzie was afraid to go sufficiently near to ascertain whether it was warm water that was ejected, but upon this point there can be little doubt. The spot where he saw the water sent up is marked on the chart as a shoal, and so long as he was in sight the water continued to be sent upwards with equal force."

THE additions to the Zoological Society's Gardens during the past week include a Toque Monkey (*Macacus pileatus*) from Ceylon, presented by Mrs. Thomas; a Macaque Monkey (*Macacus cynomologus*) from India; a Malbrouck Monkey (*Cercopithecus cynosurus*) from West Africa, presented by Mr. H. C. Marckmann de Lichtabbell; an Arctic Fox (*Canis lagopus*) from the Arctic Circle; a Black-headed Gull (*Larus ridibundus*) European, presented by Mr. Keell; a Prairie Marmot (*Arctomys ludovicianus*) from North America, presented by Mr. Thellusson; a Guilding's Amazon (*Chrysotis guildingi*) from St. Vincent, purchased; four Houbara Bustards (*Houbaria undulata*) from Tripoli, deposited.

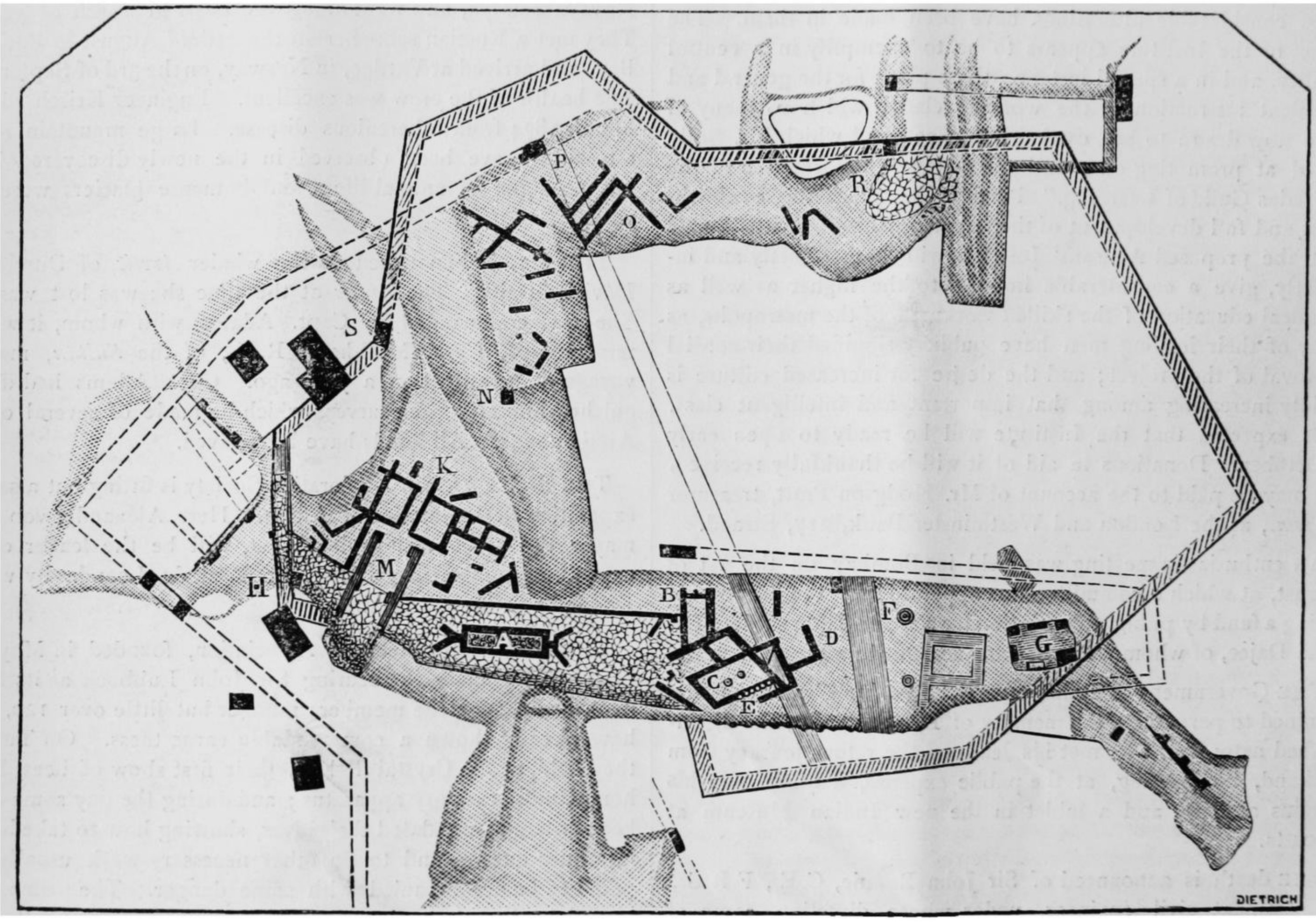

FIG. 1.—Plan of Troy in the time of Priam. A. Tower of Ilium. B. House of two storeys before the taking of Troy. C. Trojan structures and later structures superposed. D. Trojan houses. E. Large earthenware jars. F. Altar for sacrificing to the Trojan Minerva, with drain for carrying off the blood. G. Remains of Trojan houses. H. Place where the treasure of Priam has been found. K. Remains of Priam's palace. M. Gates. N. Wall prior to Troy. O. Trojan houses and later walls superposed. P. Fortified wall prior to Troy. R. Wall of defence prior to Troy. S. Remains of the *enceinte* of Troy.

*THE RUINS OF TROY: RECENT DISCOVERIES OF DR. SCHLIEMANN**

OUR age is eminently an age of investigation, and, more than any previous one, is drawn towards archæological studies by a restless and feverish ardour. Dissatisfied with the present, it rushes back into the past, to seek for traces of the most ancient origins of man and of his races, the primitive sketches due to his artistic and industrial genius, the beginnings, still so obscure, of his history, and even of prehistoric times. The learned works of Mr. Layard on Nineveh and Khorsabad, the fruitful excavations of M. Mariette in Egypt, those of the Americans in the mounds and tumuli of the Ohio and Mississippi, the discoveries, so valuable for human palæontology, due to the courageous perseverance of Boucher de Perthes and to the ingenious sagacity of M. Lartet, of Sir Charles Lyell, of Sir John Lubbock, Prof. Wilson, Mr. E. B. Tylor, and others,—does not all this indicate a very distinct movement towards researches which have for their object the vestiges which man has left on the earth or in its depths from the most remote periods?

To the number of the most recent archæological labours which have strongly attracted public attention, we must add, with good reason, the important and magnificent work of Dr. Heinrich Schliemann, which has just been published at Leipzig, under the title of "Trojanische Alterthümer" (Trojan Antiquities).

A poet has said, in speaking of the ancient city, whose misfortunes another poet has sung in immortal verse,—

"Etiam periêre ruinæ."

But Dr. Schliemann and the noble companion of his life and his labours have given the lie to Lucan. Others, it is

* Translated from an article in *La Nature*, by Dr. N. Joly, of Toulouse.

true, believed that they had discovered the ruins long ago. Towards the end of last century (1788), a French traveller, Le Chevalier, professed even to have proved that Virgil was mistaken in placing, along with all Greek antiquity, the city of Troy and its citadel on the heights indicated by Homer, the little hill which to-day bears the name of Hissarlik.* According to him, the Homeric city must have been built upon the site occupied by the present village of Bunarbashi; the citadel of Pergamos was situated, on the contrary, on one of the rocky hills which encloses the Scamander, and at the summit of which is seen three conical knolls, ranged in a line, which Le Chevalier regarded as the tombs of the Trojan heroes. As to the springs which flow from the foot of the hill, these were, according to the author of the "Voyage en Troade," those where the Trojan girls went to wash their clothes.

Although based on topographic data very open to controversy and upon texts falsely interpreted, the work published in 1788 by Le Chevalier had a very great success (three editions from 1788-1802), and his opinion, thoroughly erroneous as it was, acquired, so to speak, the force of law.

Even quite recently (in 1871), this opinion found an unfortunate defender in Dr. Karl Curtius, of Berlin, and that at the very moment when the excavations of Sir John Lubbock, of Consul Hahn, and, above all, those of Dr. Schliemann, put Bunarbashi out of the question, and brought forward the most convincing proofs in favour of Hissarlik.

In fact, these excavations have demonstrated, as far as evidence can go, that neither the pretended Trojan tombs indicated by Le Chevalier, nor the site of Bunarbashi itself, contains any archaic object, any trace of human habitation. It is, then, neither at Bunarbashi, nor at Chiblak, nor at Atchi-Kienni (which is now quite given up), that we must seek for the veritable Troy and the citadel of Pergamos. Let us see if we shall be more

FIG. 2.—Large earthenware jars found in the ruins of Troy, at E, in Fig. 1.

fortunate in carrying on our investigations on the site of Hissarlik; that is to say, in allowing ourselves to be guided by popular tradition, the writings of the most ancient trustworthy authors, and chiefly by the gigantic excavations executed at so great an expense and with so much zeal and intelligence by Dr. Schliemann and his wife.

Here, independently of the authority of Homer, we have still that of Herodotus, of Xenophon, of Arrian, of Plutarch, of Justin, who all agree in placing the Ilion of Homer at Hissarlik; that is, at the place where Dr. Schliemann has found ruins overlaid by many layers of more recent ruins. In one of these layers, which extends from seven to ten metres below the summit of the hill, are found, in fact, incontestable proofs of a violent fire,†—a palace, a double gate situated on the west of this palace, a tower rising at some distance from the double gate, religious symbols (images and vases in the shape of an owl, γλαυκῶπις Ἀθηνή), and finally a treasure containing objects which, in their smallest details, answer to the descriptions which Homer gives us. Is there not here enough to satisfy the most sceptical and most exacting?

Begun in the month of April 1870, the excavations executed by Dr. Schliemann were only terminated in October 1873. They have thus occupied him three entire years, and that in the midst of the greatest difficulties, sometimes even at the risk of his life and that of the numerous workmen, Turks and Greeks, whom he employs in these works. I pass in silence the harassing difficulties which the Turkish Government has raised to prevent him attaining the precious results with which these excavations have enriched the science of the past.

(*To be continued.*)

* For an excellent study on the topography of Troy, see an article by M. Emile Burnouf in the *Revue des Deux-Mondes* of Jan. 1, 1874.

† M. E. Burnouf places the fire in the seventeenth century B.C., 700 years, according to some, before the time of Homer.

THE BRITISH ASSOCIATION

Reports

Report of the Committee on Experiments to determine the Thermal Conductivities of certain Rocks, by Prof. Herschel and Mr. Lebour.

In the introductory notes on these experiments, published as an appendix (p. 233) in the last volume (for 1873) of the British Association Reports, the list of rocks selected and the manner of experimenting on them were described. With the exception that sections of Calton trap rock, of a great pyramid casing stone (nummulitic limestone), Caen stone (or Normandy building limestone), Cannel coal, chalk, and red brick were added to this list, and that the apparatus received some small but very important improvements to make it heat tight, the material of the experiments as well as the method of working them remained substantially the same as last year. Instead of a conical tin vessel with 1 lb. of water, a cylindrical one holding 2½ lbs., with an internal agitator and thermometer, was used as the cooler. The opposite faces of the heater and cooler were lined with velvet and each clasped by a caoutchouc collar, which, projecting a little above them, clips the circular edge of the rock plate when it is placed between them, and two small notches cut in each collar also allow the wires of a thermocouple to be introduced, touching the rock-surfaces while the rock is being heated. With the view of traversing the plate with the thermopile in different directions, the piece of stout palladium wire (about 18 gauge) used as the electromotive element between the two iron wire branches of a delicate reflecting galvanometer, was silver-soldered to the iron wires at its two ends, all the wires being first rolled thin and flat to some distance from the junctions. The scythe or scimitar-blade shape most easily given to the wire in rolling it thin was advantageous in the construction, because, instead of uniting the wires continuously in one straight length and folding the points of junction on opposite sides of the rock (thus confining their range upon it to a single diameter or to one straight line), advantage of the curvature was taken to connect the wires by superposition, instead of by prolongation at their junctions, without overlying each other, into two flat ogee arches, or merry-thought-like blades, between which the rock is held as in a forceps. The straight unrolled parts of the wires are bound very firmly to a square piece of wood, which acts as a handle to guide the points of the forceps to various parts of the rock-faces, while it keeps them securely in their places, and thus allows the small elastic pressure of the wires to clasp the rock gently between the points of the thermo-electric pincette without assistance from the velvet covers. After thus inserting a rock section in the apparatus, protecting the rock and cooler from below with a stout wooden screen, and from loss or gain of heat in other directions by a suitably thick case of woollen stuff and a few bandages of similar materials, the rate of rise of temperature in the cooler, when agitated, was noted by the average number of seconds taken by a delicate thermometer contained in it to rise ½° F. (one graduation on its stem) as soon as this rate of rise was found to have become sensibly constant. About twenty minutes were usually occupied in the beginning of an experiment with waiting for a steady condition of the thermometer readings, and ten or twelve minutes more were required to ensure it and to obtain the average rate of their increase for the rock specimen under observation. The temperature difference shown by the galvanometer at the same time at first rose rapidly to a high maximum and then descended very gradually to a fixed lower reading. The pincette was traversed to and fro over the rock surfaces while the thermometer was being noted, and exhibited during these motions fluctuations answering to about 1° or 2° F. on either side of an average position; corrected for zero of the scale and reduced by trials for this purpose between every two or three experiments to Fahrenheit degrees, the temperature difference thus formed, divided by the quantity of heat transmitted to the cooler per minute, gave the apparent thermal conductivity of the plate. The results in Peclet's units were scarcely more than one-third of what Peclet and other earlier experimenters had obtained. It was obvious that, instead of marking the temperature difference between the two solid contact surfaces of the rock and velvet which they touched, the points of the thermo-electric forceps showed the temperature of the fluid air-bath in which those two surfaces are immersed. The extreme mobility of this integument, enabling it to penetrate through the velvet to the plates of the heater and the cooler, while it equally insinuates itself between the rock surface and the thermopile that can only enter into actual solid contact with each other (at least theoretically) at three points, controls the temperature of the metallic thermometer far more powerfully than the rock face that it touches, and the real temperature differences between the rock faces are accordingly completely masked. It is very probable that if the velvet covers fitted on the instrument were replaced by soft wash-leather, the source of this error would be very much reduced; and although it is certain that the confronting surfaces of the rock and leather faces will nowhere have actually the same temperature, from the existence of a sensible quantity of resisting air between them, so that, as before, the thermopile will not mark the true rock temperature difference, but a mean between that difference and a similar difference for the leather faces, yet the range of this error will be incomparably smaller than in the experiments already made with velvet covers, whose loose texture precludes the possibility of regarding the comparative results now obtained as positively correct, or more than first approximations, from which the errors arising from surface characters of the rock sections tested have not yet been removed.

To obtain the true rock temperature differences, means were taken to cement the thermopile points to the rock with plaster, a course it would be desirable to adopt with as few samples as possible as standards of correction for the rest, on account of the tediousness of the process and the injury that it necessarily entails to the beautifully worked surfaces of many of the plates. If the correction so found to be required can be restricted by the mode of operating to a range of such small limits as to be applicable generally, without appreciable influence of the surface characters, in making its occasional departures from a mean value very sensible, then the reduction factor found by absolute experiments on a few rocks of characteristically rough and smooth or polished surfaces to obtain the true temperature difference for a given heat-flow from the apparent one shown by the thermocouple placed simply between the rock and leather faces will be admissible within the limits of error of the observations to convert a list of apparent conductivities as just supposed to be obtained from a mere comparative table of relative conducting powers to a table of absolute thermal conductivities, in which the errors of the values given will certainly not be greater than would in all probability have been committed had the direct method of absolute measurement been applied separately to each specimen of the list, instead of only to a few rocks, to furnish data on which calculations of the remainder may be founded. Circular discs of linen, well wetted with plaster of Paris, mixed with a little glue or white of egg, were laid over the surfaces of two or three of the rocks, enclosing under them and against the rock (to which they were also plaster-wetted) the two branches of the thermopile pincette. When these had set quite hard under pressure and were thoroughly dried by a gentle heat, they were placed in the apparatus, and a measurement of the absolute temperature difference and accompanying heat-flow was thus obtained, affording the real conductivity and a means of comparing it with the apparent one found by similar observations of the same rock when no plaster was used, and when the points of the thermopile merely pressed against its surface. Thus the thermo-electric difference obtained with the wire couples merely touching the surfaces of white statuary marble between velvet faces was 16°, while for the same heat-flow when the arms of the thermopile were firmly plastered to the marble plate, the temperature difference observed was only 16°·2 *—being more than 2½ times as large a difference in the former as in the latter case. With whinstone the corresponding temperature differences were 26° and 8°·5.—in the proportion of very nearly 3 : 1. A similar experiment was made with cannel coal, of which the conductivity is much less than that of the last-mentioned rocks, the temperature differences obtained being for the same heat-flow in the plain and plastered plate 53°·4 and 39°·7; in the proportion of only 1·37 : 1—a far smaller reduction than was observed in the two foregoing cases. Care is, however, necessary to introduce wet plaster under as well as over the points of the thermopile in cementing them to the rock, that air may be excluded and the junction may be solid, a precaution which was omitted in this case, as plaster without size was used, which in drying sometimes flakes off (from the

* The heat-flow through the plate was actually greater in this latter than in the former case in the proportion of about 5 : 4, showing that the rough plaster-washed linen surface received and delivered heat to the velvet covers much more readily than the smoothly-dressed surface of the stone, and the whole resistance was less in the latter than in the former case, although the rock plate itself had been made thicker. The same diminution of the total resistance occurred also in the experiment with plastered whinstone.

rock surface either entirely or in places. This may render an experiment, as that on cannel coal may not impossibly have been, from this cause entirely valueless; yet this result presents itself, with many others met with in the investigation, as very well worth repetition, with fresh precautions and with new arrangements to guard against the possibility of false conclusions.

Adopting for the present, as probably not very far from the truth, a common reduction factor of $2\frac{3}{8}$ as the proportion in which the recorded temperature differences of the plain rock surfaces between velvet faces exceeded the true temperature differences of the surfaces of the rocks examined, and introducing some very small corrections for the thicknesses of the plates, the thermal capacity of the metal cooler, &c., which are all probably (as well as the allowance for heat-absorption in raising the temperature of the rock plates very slowly during the observations) really negligible in comparison with the uncertainty that attaches (except in one or two well-observed cases of absolutely measured temperature differences of the rock faces) to the great majority of the determinations from unknown peculiarities of surface contact and temperature assimilation where air is not excluded from the junctions, or rendered stagnant in its mode of heat transmission, the following table gives the absolute thermal conductivities (in centimetre-gramme-second, or absolute British Association units) thus provisionally obtained, together with a few similar results found by Peclet, Forbes, and Sir William Thomson in rocks differing little in their description from those included in the present list.

Provisional Determinations of Thermal Conductivities of certain Rocks.—First Experimental Results.

Description of Rock.	Thermal conductivity (gramme-water-degree heat units per second) at 1° difference of the faces, through a centimetre cube.	Earlier Observations of Conductivities of similar Rocks.		
			Description of Rock.	Observers.
Grey Aberdeen granite...	·00600			
Red Cornish serpentine	·00483			
Calton trap rock (first specimen)... ...	·00520	·00266	Calton trap rock	Forbes and Thomson.
Whinstone	·00312	·00169	Sand of experimental rock, Thermometer garden	Forbes and Thomson.
Kenton sandstone	·00489	·00689	Cragleith sandstone	Forbes and Thomson.
Congleton "second grit" stone	·00462			
Slate	·00392			
Alabaster	·00412			
Sicilian white statuary marble	·00559	·0097	Fine-grained grey marble...	Peclet.
Irish fossil ditto	·00559	·0077	Coarse crystalline white ditto	Peclet.
Devonshire red ditto	·00525	·0058	Fine-grained calcareous stone.	Peclet.
Italian vein marble (white, grey veins)	·00512	·0047	,, ,, ,,	Peclet.
Irish green marble	·00507			
Nummulitic limestone (a piece of Great Pyramid casing-stone)	·00433			
Caen (building) limestone	·00395	·0037, ·0035	Coarse-grained lias building stone	Peclet.
Chalk...	·00384			
Black shale (Newcastle-on-Tyne) ...	·00178			
Cannel coal	·00101			
Plaster of Paris (for castings)	·00163	·00145, ·00122	Ordinary fine plaster (made up) ... ...; Finest ditto for casting (made up)	Peclet.

The Report of the Committee for superintending the monthly reports of the progress of Chemistry, by Profs. Roscoe and Williamson, was then read by Prof. Roscoe. The report was very short; the committee does not intend to apply to the British Association for a further grant after the present year.

Report of the Committee on Essential Oils, by W. Chandler Roberts.—The following oils have been examined: Wormwood, Citronella, and Cajeput. The actions of phosphorus pentasulphide, of zinc chloride, and of bromine upon the oils were described. The first-named reagent generally acts by removing the elements of water, with formation of terpenes and cymenes. Zinc chloride generally causes decomposition, giving rise to a mixture of hydrocarbons. Bromine usually forms a bromide, which is then decomposed with evolution of hydrobromic acid and water and formation of a cymene.

Various cymenes have been examined, all of which seemed to be the same. The formation of cymenes from terpenes by the action of sulphuric acid has been verified. Cymenes have also been obtained from oil of turpentine by continued fractionation.

The following numbers express the optical properties of some of these oils:—

	Specific refractive energy.	Specific dispersion.
Absinthol	·4887	·0234
Cajeput	·4916	·0251
Citronella	·5213	·0289
Citronellol	·5176	·0284

The conclusion drawn is, that cymene is the central body in these essential oils, to which the other constituents are closely related; the varying amounts of mechanical energy required for the formation of the different isomerides have not as yet been determined.

Dr. Gladstone said that the optical properties of sixteen cymenes had been examined. Some of these were obtained from substances of low, others from substances of high refractive energy, but in all cases the refraction of the cymene was the same; the refraction of a substance depends, therefore, on the constitution of the substance itself.

Report of the Committee on the Estimation of High Temperatures, by J. Dewar, F.R.S.E.—The committee has not carried on any investigations during the past year.

Gold Assays, by W. Chandler Roberts.—Little has been done by the committee during the past year, but they hope to be able to report fully at the next meeting.

Report of the Committee for assisting in the Exploration of the Victoria Cave, Settle, by R. H. Tiddeman, secretary to the committee.

The explorations have been continued throughout the chief part of the year. The Settle Committee have raised by private subscriptions and spent, besides the British Association grant of 50*l.*, a sum of 113*l.* 4*s.* 3*d.* The late determination of a bone which had been found by the committee in the cave in May 1872 as human, by so great an authority as Prof. Busk, induced the committee to pay their chief attention to the question of its position and the relation of the beds in which it occurred to the physical changes to which the district has been from time to time subjected. In order to do this it was necessary to remove a large portion of the tip of the older workings, which had unfortunately accumulated below the entrance of the cave. Beneath this the Romano-Celtic layer was reached, and several objects of bronze, including bracelets, a vinaigrette, and other articles, were obtained. The Romano-Celtic layer was from 1 ft. to 1 ft. 6 in. thick; beneath this was a thickness of 19 ft. of screes, consisting of angular fragments of limestone, which had fallen from the face of the cliff above. This contained no bones whatever, nor the smallest fragment of any rock but the white limestone of which the cliff above is made. But at the base of this a great many boulders were discovered of all dimensions up to 7 ft. in diameter. The number of these boulders and the peculiar conditions of their position render it quite impossible that they can have been brought through any fissure in the roof of the cave and so washed in later times over the beds containing the human fibula and the remains of the older mammals. The great weight of some of them quite militates against this idea. Another suggestion, that they may not have been left in their present position at the melting of the ice-sheet, but may have fallen from the cliff in comparatively recent times, is also negatived by the complete absence of any evidence of any such fall through the long period represented by the 19 ft. of screes, their occurrence only at the base of the screes, and by the absence of any drift from the cliff above for some distance round. But another strong argument against this supposition lies in the fact that the boulders are so close beneath the cliff, that if all the limestone weathered from the cliff above and now resting on the boulders were restored to the cliff it would project so much further forward that it would be impossible for them to fall into their present position; yet we know from their position that the boulders were dropped there before any portion of the screes had accumulated, and therefore at a time when the roof of the cave undoubtedly reached much further forward.

The inevitable conclusion is that man lived in Yorkshire with *Elephas antiquus*, *Rhinoceros tichorinus*, *Ursus priscus* and *spelæus*, *Hyæna*, *Bison*, and red deer long before the existence of the great ice-sheet in Northern Britain and Ireland.

Report of the Boulder Committee.

The Rev. W. H. Crosskey read the report of this committee appointed for the purpose of recording the position, height above the sea, lithological characters, size, and origin of the more important erratic blocks, and groups of erratic blocks, of England and Wales, and reporting other matters of interest connected with them. A schedule has been issued by the committee containing detailed questions of the information required. The object of the committee is not speculative, but to collect the facts, with the intention of afterwards proceeding to their classification, and pointing out their relations to the various theories under designation in glacial geology. Districts in which boulders are rarest are of special importance. The evidence regarding the southward extension of the ice sheet and the reach of the waters of the glacial sea depends largely upon their presence and absence; while their method of distribution is full of geological meaning. The necessity for the work of the committee is increased by the fact that all over England and Wales the destruction of boulders is rapidly proceeding. In the midland districts, a map is being constructed in which the approximate number of boulders and the character of the rocks of which they are formed, together with the effect of the configuration of the country on their distribution, will be shown. From the general position of the boulders it is evident that boulders were deposited at several ages. There are (1) boulders of the earliest ice periods, (2) boulders of the period of submergence, distributed in the lower parts of the glacial clays, (3) boulders of the period of the re-elevation of the land. These varieties have yet to be traced to their various sources, and upon this work members of the committee are engaged. It is as impossible to assign all the boulders to one epoch of distribution, as it is to relegate all glacial sands, clays, and gravels to one period. The report contains details regarding boulders of various districts. From Leicestershire, one fact of especial importance is recorded. Below the drift clay and quite distinct from the surface boulders freely scattered over the country, a group of boulders has been exposed in an excavation made in the centre of Leicester, 25 ft. deep, composed of rocks of foreign origin, and suggesting a stranded iceberg of an early period. In the same county, isolated boulders of large size, and groups traceable to sources some miles distant, prove Charnwood Forest to have been a centre of ice-action of considerable intensity. In Warwickshire a great change occurs. The drift-beds are reduced almost to pebbles; and local geologists give the name of boulders to specimens which in other parts would not be regarded as worthy of the name. Striations are faint and rare. Their grouping is remarkable, and they come from all points of the compass. Isolated boulders are recorded from Northumberland, Yorkshire, Lancashire, Devonshire, and Denbighshire. The committee request members of the Association who have received schedules to return them, and desire communications from geologists disposed to assist them in their work.

The Close Time Committee.

A report was read from the Close Time Committee with reference to the desirableness of establishing a close time for the preservation of indigenous animals. After stating the steps which had been taken with reference to this subject in Parliament, the committee stated its belief that the effect of birds' nesting on such kinds of birds as are known to be diminishing is altogether inappreciable, while its effect on those whose numbers are not decreasing may be safely disregarded, and consequently that there is no need of any legislative interference with the practice. The committee believed that the only practicable mode of checking the diminution of such birds as have been proved to be decreasing is the effectual protection of the adults from destruction during the breeding season. While the Sea Bird's Preservation Act continued to work successfully, the Wild Birds Protection Act had done little, if anything, towards attaining the objects for which it was passed, and in various quarters gave considerable discontent. Birds commonly known as "wild fowl" were subjected to very great persecution through the inadequacy of the present law to protect them; they were rapidly reducing in number; they were not only innocuous, but were of great value as food. Consequently the committee hoped that the efforts they intended to make on behalf of wild fowl in the next session of Parliament would obtain a general support. Representations as to the inordinate slaughter of seals which took place every spring in the North Atlantic Ocean had been made to some members of the committee. There could be no doubt that such slaughter at that season would soon bring these animals to the verge of extermination, as had been the case in many other parts of the world, and since their destruction would affect a very large trade, their proper protection seemed to be a subject not at all unworthy of the consideration of the Government. The committee requested their reappointment.

SECTIONAL PROCEEDINGS

SECTION A—MATHEMATICS

On the Perturbations of the Compass produced by the rolling of the Ship, by Sir William Thomson.

The heeling error which has been investigated by Airy and Archibald Smith is the deviation of a compass produced by a "steady heel" (as a constant inclination of the ship round a longitudinal axis, approximately horizontal is called). It depends on a horizontal component of the ship's magnetic force, introduced by the inclination; which compounded with the horizontal component existing when the ship is upright, gives the altered horizontal component when the ship is inclined. Regarding only the error of direction and disregarding the change of the intensity of the directing force, we may define the heeling error as the angle between the directions, for the ship upright and for the ship inclined, of the resultant of the horizontal magnetic forces of earth and ship at the position of the compass. These suppositions would be rigorously realised with the compass supported on a point in the ordinary manner if the bearing point were carried by the ship uniformly in a straight line. They are nearly enough realised in a large ship to render inconsiderable the errors due to want of perfect uniformity of the motion of the bearing point if this point is placed anywhere in the "axis of rolling," * for in a large ship the compass, however placed, is not considerably disturbed by pitching, or by the inequalities of the translatory motion caused by waves.

Hence, supposing the compass placed in the axis of rolling, the perturbation produced in it by the rolling will be solely that due to the variation of the horizontal component of the ship's magnetic force. Such a position of the compass would have one great advantage—that the application of proper magnetic correctors adjusted by trial to do away with the rolling error would perfectly correct the heeling error. To set off against this advantage there are two practical disadvantages: one that the axis of rolling (being always below deck) would not be a convenient position for the ordinary modes of using the compass; the other, far more serious, that in ships, at all events with iron decks, the magnetic disturbance produced by the iron of the ship would probably be so much greater at any point of the axis of rolling than at suitably chosen positions above deck as to more than counterbalance the grand kinetic advantage of the axial position. But careful trials in ships of various classes ought to be made, and it *may* be found that in some cases the compass may with preponderating advantage be placed at the axis of rolling. Hitherto, however, this position for the compass has not been used in ships of any class, and, as we have seen, it is not probable that it can ever be generally adopted for ships of all classes. It is therefore an interesting and important practical problem to determine the perturbations of the compass produced by oscillations or other non-uniform motions of the bearing point.

The general kinetic problem of the compass is to determine the position at any instant of a rigid body, consisting of the needles, framework, and fly card, which for brevity will be called simply the compass, moveable on a bearing point, when this point moves with any given motion. Let the bearing point experience at any instant a given acceleration, α, in any given direction. Let w be the mass (or weight) of the compass, and gw the force of gravity upon it, reckoned in kinetic units. The

* One way, probably the best in practice, of finding by observation the position of the axis of rolling is to hang pendulums from points at different levels in the plane through the heel perpendicular to the deck, till one is found which indicates the same degrees of rolling as those found geometrically by observing a graduated scale (or "batten") seen against the horizon.

position of kinetic equilibrium of the compass at that instant is the position in which it would rest under the magnetic forces and a force of *apparent gravity* equal to the resultant of *gw* and a force *aw* in the direction opposite to that of *a*. Now the weight of the compass is so great, and its centre of gravity so low, that the level of the card is scarcely affected sensibly by the greatest magnetic couple experienced by the needles.* Hence, in kinetic equilibrium the plane of the compass card is sensibly perpendicular to the direction of the "apparent gravity" defined above; and the magnetic axis of the needles is the direction of the resultant of the components in this plane of the magnetic forces of earth and ship. Hence it is simply through the *apparent level* at the place in the ship occupied by the compass differing from the true gravitation level that the problem of the kinetic equilibrium position of the compass in a rolling ship differs from the problem of the heeling error referred to above. That we may see the essential peculiarities of our present problem, let there be no magnetic force of the ship herself or cargo. The kinetic equilibrium position of the magnetic axis of the compass will be simply the line of the component of terrestrial magnetic force in the plane of the apparent level. The author then investigates, by a mathematical process, an expression for "the kinetic equilibrium error," which is so named in order to distinguish it from the error actually exhibited by the compass. The kinetic equilibrium error is exactly the error which would be shown by an ideal compass with infinitely short period of vibration. A light quick needle (either with silk fibre suspension or supported on a point in the ordinary way), having a period of not more than about two seconds, shows the rolling error very beautifully, taking at every instant almost exactly the position of kinetic equilibrium. Sir W. Thomson has thus found it so great in a small wooden sailing vessel that it became very difficult to make exact observations with the quick compass, either in the Firth of Clyde or out at sea on the Atlantic, unless when the sea was exceptionally smooth. The kinetic theory of forced oscillations is readily applied to calculate, whether for a wooden or an iron ship, the actual "rolling error" of the compass from the "kinetic equilibrium error," but the author remarks that it would extend the present communication too far to enter on details of this solution. For the present it is enough to say that no admissible degree of viscous resistance can make the rolling error small enough for practical convenience, unless also the period of the compass is longer than that of any considerable rolling to which the ship may be subjected. Probably a period of from fifteen to twenty seconds (such as an ordinary compass has) may be found necessary for general use at sea; and it becomes an important practical question how this is best to be obtained, consistently with the smallness of the compass needles necessary for a thoroughly satisfactory application of the system of magnetic correctors, by which the Astronomer Royal proposed to cause the compass on an iron ship to point correct magnetic courses on all points.

On the Spectrum of Coggia's Comet, by Dr. Huggins.—The new point noticed in this communication was that the bands of the comet were so far shifted as to indicate—supposing there really was carbon in the comet—that the relative motion of the approach of the comet to the earth was forty-six miles per second. The comet really, however, approached the earth at the rate of twenty-four miles per second; and it was therefore uncertain whether the whole or part of the difference in this velocity was due to the motion of matter within the comet. The brighter portion of the head of the comet was due evidently to a larger proportion of the matter giving a continuous spectrum. It seemed probable, therefore, to the author that the nucleus was solid, heated by the sun and throwing out matter which formed the coma and tail; and part of this was in a gaseous form, giving the spectra of bright lines. The other portion existed probably in small incandescent particles; the polariscope showing that certainly not more than one-fifth of the whole light was reflected solar light.

Further Experiments on Light with circularly ruled plates of glass, by Philip Braham, F.C.S.

Interposing plates of circularly ruled glass in the beam of light from a heliostat, the rings of colour are in the same order by reflection and refraction, the red in both cases being outward.

Observing the rings of reflected colour when the unruled surface of the glass is away from the heliostat, dark bands make their appearance concentric with the coloured rings, if the surface of the rulings is at right angles to the direction of the beam, and on altering the angle of the ruled plate the dark bands expand until they intersect the coloured circles, and also appear considerably beyond them.

Placing a polished plate of speculum metal in contact with the ruled surface of the glass increases the intensity of the dark bands, and by adjustment shows that according to the distance of the reflecting surface from the ruled, the number and thickness of the dark bands are increased or diminished.

A description was given of the heliostat used, the reflector being a rectangular glass prism.

* Generally no adjusting counterpoise for the compass is required when a ship goes from extreme north to extreme south magnetic latitudes.

SECTION B—CHEMICAL SCIENCE

The Chemical Composition of Jute Fibre, by Prof. Hodges.—The jute plant belongs to the family Tiliaceæ. The *Corchorus capsularis* and *C. olitorius* are both cultivated.

The structure of the fibre is different from that of other textile fibres, the central space being very irregular, varying from the thickness of a line to a considerable width.

By the action of aniline sulphate, jute fibre becomes of a golden yellow colour, whereby it is distinguished from hemp and flax. The following is the analysis of jute fibre:—

Wax and fatty matter soluble in ether	0·235
Tannic acid and colouring matter soluble in alcohol	1·135
Sugar, pectine, &c.	2·427
Soluble nitrogenised matters	0·512
Insoluble ,, ,, ...	2·433
Inorganic matter combined with fibre	1·010
Cellular fibre	92·248
	100·000
Nitrogen in original fibre	0·291
Nitrogen in fibre after treatment with solvents ...	0·210

Methyl-thetine, by Prof. Crum Brown and Dr. E. A. Letts.—By the action of bromacetic acid on methyl-sulphide, methyl-thetine hydrobromate is produced. By the action of moist silver oxide on this hydrobromate, silver bromide is found, and by the further cautious addition of the hydrobromate, the silver remaining in solution is removed. By evaporation, crystals of the base methyl-thetine are formed with one molecule of water. This crystallised base might be represented by the structural formula:—

$$\left.\begin{array}{c} S(CH_3)_2 \\ | \\ H-C-COO \\ | \\ H \end{array}\right\} + H_2O.$$

By the decomposition of the sulphate of methyl-thetine by means of barium carbonate, the base may also be prepared.

This substance, methyl-thetine, has both a basic and an acid character; with hydrochloric acid it forms a hydrochloride, from which the double platinum chloride has been prepared. A double lead compound containing $2PbBr_2$ has also been prepared.

The action of iodacetic acid on methyl-sulphide does not give rise to the formation of methyl-thetine hydriodate, as might have been expected; but various substances are formed, among which is trimethyl-sulphine iodide.

Experiments on High Pressures, by Dr. Andrews, F.R.S.—The author entered into full details of the methods of preparing and using his well-known tubes for the production of high pressures. If a mixture of nitrogen and carbonic acid be subjected to high pressures (to 200 atmospheres), no trace of liquid is produced.

On the Latent Heat of Liquefied Gases, by J. Dewar, F.R.S.E.—The author has deduced a formula for calculating the latent heat of a gas from the known tension of that gas. The results of this investigation have already been communicated to Section A.

On Spontaneous Generation from a Chemical Point of View, by Dr. Debus, F.R.S.—To the question, "Has Nature ever produced organic substances from strictly inorganic materials?" Chemistry (according to the author) answers, "No!"

On the Estimation of Phosphoric Acid in Pyrophosphate of Magnesia, by Mr. Ogilvie. The author's experiments lead him to conclude that this process cannot be relied upon unless taken in conjunction with some other, such as the Molybdate process. The influence of a great excess of magnesia, of ammonic oxalate, of citric acid, and of alumina or iron oxide, introduces sources of error.

On an Improved Form of Filter Pump, by W. Jesse Lovett.—This pump, which is very simple and appears to give good results, has already been described in the *Chemical News*.

On Sulphur-Urea, by Prof. Emerson Reynolds.—By heating dry ammonium sulphocyanate, sulphur-urea—as has been before shown by the author—is obtained. If the heat be maintained at 170°, about 26 per cent. of urea is obtained in one hour. By the action of metallic oxides in solution on sulphur-urea, metallic sulphides are obtained, together with cyanamide, which, by the prolonged action of water, is changed into dicyanamide.

On the Joint Action of Carbonic Acid and Cyanogen on Oxide of Iron, and on Metallic Iron, by Lowthian Bell, F.R.S.—The author shows that a mixture of carbonic acid (CO_2) and cyanogen exercises a powerful reducing action at a high temperature upon ferric oxide. With one volume of cyanogen and six volumes of carbonic acid at a temperature of 685° to 710° F., 79·9 per cent. of the oxygen existing in combination with iron was removed, 56·3 per cent. of metallic iron being produced; by increasing the proportion of carbonic acid to fifteen volumes, 6·5 per cent. of metallic iron was produced, while ·9 per cent. only was formed when the carbonic acid amounted to thirty volumes. A certain amount of carbon is simultaneously deposited in the reduced iron. The reducing and carbon depositing power of a mixture of cyanogen and carbonic acid is greater than that of a mixture of carbon monoxide and carbonic acid.

Electrolytic Experiments on Metallic Chlorides, by Dr. Gladstone, F.R.S., and Mr. Tribe.—The authors show that if plates of copper and platinum be immersed in a dilute solution of cupric chloride, a current is obtained from the copper to the platinum, the cupric chloride is broken up into cuprous chloride and chlorine, the former being deposited on the platinum, while the latter combines with some of the copper to form a new cupric chloride $Cu + CuCl_2 = 2\,(CuCl)$. By applying an external current the same action takes place; if, however, the strength of the current be increased, the free chlorine makes its appearance. By substituting zinc for copper a greater effect is obtained; with magnesium in the place of zinc, the effect is still greater. Analogously to the foregoing, a current may be obtained by acting on a solution of mercuric chloride with gold and mercury, whereby mercurous chloride is deposited on the gold.

Composition of certain kinds of Food, by W. J. Cooper.—The author drew attention to the nourishing properties of farinaceous foods, such as arrowroot, corn flour, &c. Such foods he believes very well suited for infants and invalids. He holds that we generally take too much nitrogenous substance in our dietaries.

SECTION C—GEOLOGY

Prof. Harkness, at the request of the Committee of the Section, described briefly the geological features of the North of Ireland. The relations of the Silurian rocks to the Lower Silurians of Sutherlandshire and Cumberland were discussed, and the later formations were noticed in succession.

Prof. H. A. Nicholson exhibited and described a silicified chip of wood from the Rocky Mountains. At the Brighton meeting the same specimen was shown, when the opinion was expressed that its wood-like appearance was due to mineral structure. The chip was then regarded by some members of the Section as a hornblendic mineral, known as "rock-wood." Subsequent examination has shown conclusively that the specimen is undoubtedly true silicified wood. The age of the chip and the circumstances of its production present many points of interest. The author considers it a prehistoric relic, produced by an axe, which was probably formed out of the native copper so frequent in various parts of North America.

Prof. Harkness accepted the views of the author, and withdrew his previous opinion that the specimen was merely a hornblendic mineral.

SECTION D—BIOLOGY

DEPARTMENT OF ZOOLOGY AND BOTANY

Mr. Gwyn Jeffreys read a paper *On additions to British Mollusca, and notices of rare species from the deep water off the western coast of Ireland.* As many as forty-seven species of molluscs new to science have been yielded as the results of the dredgings in the *Porcupine*, eighty-four new to the British Isles, and 124 new to Ireland, in addition to a number of other species hitherto considered to exist only in the fossil condition, some of them as low down as the Crag. Dr. Carpenter called attention to the enormous importance of these dredging expeditions, not so much from the number of new species discovered by them as from the light which they seem likely to shed on the question of the continuity of forms of life from one geological age to another. The dredgings off Ushant at a depth of nearly three miles have been especially prolific of results. Dr. Carpenter held out some hopes that the Government might be induced to undertake the expense of a dredging expedition in our own deep seas.

Mr. P. L. Sclater read a paper *On the distribution of the species of Cassowaries.* Until very recently there was supposed to be only one species of *Casuarius*; now at least seven species are known, each with a distinct and very limited area, the genus being entirely confined to Northern Australia, New Guinea, and the adjacent isles. A full exploration of New Guinea would probably lead to the discovery of a large number of most interesting new species.

On the cause of the potato disease and the means of its prevention, by Mr. J. Torbitt. The idea thrown out in the paper was that the disease is owing to the gradual natural decay of particular varieties which never have more than a limited length of life in a thoroughly healthy condition, a view which was combated by most of the gentlemen who took part in the discussion. Mr. Carruthers described the mode in which the spores of the *Peronospora* germinate in enormous numbers on the surface of the potato plant, the germinating filaments, however, only developing to a very limited extent and dying away unless abundantly supplied with moisture. It is only by this means that they are enabled to penetrate into the internal tissues through the stomates. Prof. Du Barry's recent researches seem to point to the possibility that we have in the *Peronospora* an instance of "alternation of generations," one generation only being at present known, the other generation possibly presenting an altogether different appearance, and germinating upon some totally different plant.

Prof. Macalister read *Notes on the specimen of Selache maximus lately caught at Innisboffin.*

Further Researches on Eozoön canadense, by Dr. Carpenter. After an historical account of the controversy respecting this organism, the author proceeded to give additional reasons, the results of recent investigations, for concluding the organic nature of the organism, in opposition to the views entertained by Profs. King and Rowney, of Galway. He took the opportunity of contradicting the assertion made by those gentlemen that Prof. Max Schultze had just before his death stated his conversion to their views. Mr. Gwyn Jeffreys, Prof. Macalister, and Prof. Percival Wright expressed their general concurrence in Dr. Carpenter's views.

SECTION G

MECHANICAL SCIENCE

OPENING ADDRESS BY THE PRESIDENT, PROF. JAMES THOMPSON, LL.D.

For a number of years past it has been customary in this and other sections of the British Association for the Advancement of Science, that the president should give an introductory address at the opening of each new session. In compliance with that usage, I propose now to offer to you a few brief remarks on various subjects of mechanical science and practice. These subjects have not been chosen on any systematic plan. I have not aimed at bringing under review the whole or any large number of the most important subjects at present worthy of special notice in engineering or in mechanics generally. I intend merely to speak of a few matters which have happened to come under my notice, or have engaged my attention, and which appear to me to be interesting through their novelty or through their important progress in recent times, or to merit attention as subjects in which amendment and future progress are to be desired.

In railway engineering, one of the most important topics for consideration, as it appears to me, is that which relates to the abatement of dangers in the conducting of the traffic. The traffic of many of our old railways has become enormously increased in recent years. With the construction of new lines the numbers of junctions, stations, and sidings have been greatly in creased; and each of these entails some attendant dangers. As a natural consequence of the increased traffic on old railways, the additional traffic on new lines, and the increased complexity of the railway system as a whole, there have been during recent years more numerous accidents than in the earlier times of railways. It is to be recollected, however, that with a greater number of people travelling daily, more numerous accidents might be expected, and that their increased frequency, on the whole, does not necessarily indicate increased danger to the individual traveller. Referring to the statistics of railway accidents published by the Board of Trade in Capt. Tyler's Report for the year 1873, I find, for various periods during the last twenty-seven years, throughout the United Kingdom, the proportion of passengers killed from all causes beyond their own control, to the number of passengers carried, to have been, in round numbers:—

Proportion of number killed to number carried in the three years 1847, 1848, and 1849,	1 in 4,782,000
In the four years, 1856, 57, 58, and 59	1 in 8,708,000
In the four years, 1866, 67, 68, and 69	1 in 12,941,000
In the three years, 1870, 71, and 72	1 in 11,124,000
And in the single year 1873	1 in 11,381,000

It is thus gratifying to observe, that in spite of the increased risks naturally tending to arise through the increased and more crowded traffic and the more complicated connections of lines, the danger to the individual traveller is now less than half what it was 26 years ago; at least this result is indicated, in so far as we can judge, from the statistics of deaths of passengers from causes beyond their own control. That the conducting of the traffic of railways still involves hazards far from inconsiderable, and that we have much to wish for towards abatement of dangers of numerous kinds, is proved by the fact that during the single year 1873 there have been killed of the officers and servants of the railway companies in the United Kingdom, 1 out of every 323: so that, at this rate, extended through a period of, for example, 20 years' service, there would be 1 out of every 16 of the officers and servants killed.

These deaths of officers and servants are not to be supposed to be caused in any large proportion by collisions, and by other accidents to trains in rapid motion. The great majority of them arise in shunting and other operations at stations and along the lines, and occur in numerous ways not beyond the control of the individuals themselves. In respect to the passengers, too, it ought to be known and distinctly recollected, that although collisions and other violent accidents to trains in rapid motion, together with other accidents beyond the control of the individuals, usually cause by far the deepest impression on the public mind; yet the numbers of these fatal accidents are small in comparison with others arising to passengers from causes more or less within their own control. For instance, it may be noticed that in last year, the year 1873, while the deaths of passengers arising from all causes beyond their own control, in the United Kingdom, were only 40 in number, there were four times as many killed, namely 160, in other ways; and of these there were as many as 62 killed in the simple way of their falling between carriages and platforms.

In respect to the conducting of the traffic of the trains in motion, it appears to me, on the whole, that when we consider the vast complexity of the operations involved in working many of our ramified and crowded railways, and when we consider the indefinitely numerous things which must individually be in proper order for their duty, and must be properly worked in due harmony by men far away from one another, some stationed on the land, and others rushing along on the engines or trains, the wonder is, not that we should have numerous accidents, but that accidents should not be of far more frequent occurrence. There can be no doubt, however, but that of the accidents which do occur, many arise from causes of kinds more or less preventible according to the greater or less degree in which due precautions may be adopted.

Gradually, during a period of 20 or 30 years past, a very fine system of watching, signalling, and otherwise arranging for the safety of trains, has been contrived and very generally introduced along our principal lines of railway. In saying this, I allude chiefly to the block system of working railways, with the aid of telegraphic signals and interlocking mechanisms for the working of the points and signals.

In former times it was customary to allow a certain number of minutes to elapse after a train passed any station, or junction, or level crossing, or other point where a servant of the company was stationed, before the succeeding train was allowed to pass the same place. Thus, at numerous points along the line a time interval was preserved between successive trains. It was quite possible, however, that the foremost of the two trains, after passing any of these places where signals were given, might become disabled, or might otherwise be made to go slowly, and that the following train might overtake it, and come into violent collision with it from behind. In order to provide against the occurrence of such accidents, a system was introduced called the *Block System*; and its main principle consists in dividing the line into suitable lengths, each of which is called a *block section*, and allowing no engine or train to enter a block section until the previous engine or train has quitted that portion of the line. In this way a space interval of at least the length of a block section is preserved between the two trains at the moment of the later train's passing each place for signalling, and the risk of this space interval becoming dangerously small by negligence or other accidental circumstances, as the later train approaches the next place for signalling, is almost entirely avoided.

Further, at each signalling station, the various levers or handles for working the points, and those for working the semaphore signals for guiding the engine-drivers, instead of being, as was formerly the case, scattered about in various situations adjacent to the signalling station, and worked often, some by one man and some by another, without sufficient mutual understanding and without due harmony of action, are now usually all brought together into one apartment called the signal cabin. This cabin, like a watch-tower, is usually elevated considerably above the ground, and is formed with ample windows or glass sides, so as to afford good views of the railway to the man who works the levers for the semaphores and points, and who transmits, by electricity, signals to the next cabins on both sides of his own, and, when necessary, to other stations along the line of railway.

The interlocking of the mechanisms for working the points and for working the semaphores which, by the signals they show, control the engine-drivers, consists in having the levers by which the pointsman works these points and signals, so connected that the man in charge cannot, or scarcely can, put one into a position that would endanger a train, without his having previously the necessary danger signal or signals standing so as to warn the engine-driver against approaching too near to the place of danger.

The latest important step in the development and application of the block system is one which has just now been made in Scotland, on the Caledonian Railway. Before explaining its principle, I have first to mention that a semaphore arm raised to the horizontal position is the established danger-signal, or signal of debarring an engine-driver from going past the place where the signal is given. Now, the ordinary practice has been, and still is, to keep the semaphore arm down from that level position, and so to leave the line open for trains to pass, except when the line is blocked by a train or other source of danger on the block section in front of that semaphore, and only to raise the semaphore arm exceptionally as a signal of danger in front. The new change, or improvement, now made on the Caledonian Railway consists mainly in arranging that along a line of railway the semaphore arms are to be regularly and ordinarily kept up in the horizontal position for prohibiting the passage of any train, and that each is only to be put down when an approaching train is, by an electric signal from the cabin behind, announced to the man in charge of that semaphore, as having entered on the block section behind, and when, further, that man has, by an electrical signal sent forward to the next cabin in advance, inquired whether the section in advance of his own cabin is clear, and has received in return an electrical signal meaning "*The line is clear: you may put down your debarring signal, and let the train pass your cabin.*" The main effect of this is, that along a line of railway the signals are to be regularly and ordinarily standing up in the debarring position against allowing any train to pass; but that just as each train approaches, and usually before it has come in sight, they go down almost as if by magic, and so open the way in front of the train, if the line is ascertained to be duly safe in front; and that immediately on the passage of the train they go up again, and by remaining up keep the road closed against any engine or train whose approach has not been duly announced in advance so as to be known at the first and second cabins in front of it, and kept closed, unless the entire block section between those two cabins is known to have been left clear by the last preceding engine or train having quitted it; and is sufficiently presumed not to have met with any other obstruction, by shunting of carriages or waggons, or by accident, or in any other way.

This new arrangement, which appears to be a very important improvement, has already been brought into action with success on several sections of the Caledonian Railway; and it is being extended as rapidly as possible on the lines of the Caledonian Company, where the ordinary mode of working the block system has hitherto been adopted.

The mechanisms and arrangements I have now briefly mentioned are only a portion of the numerous contrivances in use for abatement of danger in railway traffic. It is to be understood that by no mechanisms whatever can perfect immunity from accidents be expected. The mechanisms are liable to break or to go wrong. They must be worked by men, and the men are liable to make mistakes or failures. We shall continue to have accidents; but, if we cannot do away with every danger, that is no reason why we should not abate as many dangers as we can.

Within the past twenty years very remarkable progress has been made in steam navigation generally, and more especially, I would say, in oceanic steam navigation. In this we meet with the realisation of great practical results from the combination of improved mechanical appliances, and of physical processes depending on a more advanced knowledge of thermodynamic science.

The progress in oceanic steam navigation is due mainly to the introduction jointly of the screw propeller, the compound engine, steam jacketing of the cylinders, superheated steam, and the surface-condenser.

The screw propeller, in its original struggle for existence, when it came into competition with its more fully developed rival, the paddle-wheel, met with favouring circumstances in the want then strongly felt of means suitable for giving a small auxiliary steam-power to ships arranged for being chiefly propelled by sails. For the accomplishment of this end the paddle-wheel was ill suited; and so the screw propeller got a good beginning for use on long oceanic voyages. Afterwards, in the course of years, there followed a long series of new inventions and improved designs in the adaptation of the steam-engine for working advantageously with the new propeller; and it has resulted that now, instead of the screw being used as an auxiliary to the sails, the sails are more commonly provided as auxiliaries to the screw. For long oceanic voyages it became very important or essential to get better economy in the consumption of fuel. In order to economise fuel, high-pressure steam, with a high degree of expansion and with condensation, was necessary. This led to the practical adaptation for the propulsion of vessels of the compound engine, an old invention which originated with Hornblower in the latter part of the last century, and was afterwards further developed by Wolff. The high degrees of expansion could not be advantageously used in cylinders heated only by the ordinary supply of steam admitted to them for driving the piston; and more especially when that steam was boiled off directly from water without the introduction of additional heat to it after its evaporation. The knowledge of this, which was derived through important advances made in thermo-dynamic science, led to the introduction into ordinary use in steam navigation of steam-jacketed cylinders, and to the ordinary use also of superheated steam. With increased efforts towards economy of space in the hold of the ship, which became the more essential when very long voyages were to be undertaken, and with the new requirement of greatly increased pressure in the steam, the old marine boilers, with their flues of riveted plates, were superseded by tubular boilers more compact in their dimensions and better adapted for resisting the high pressure of the steam. In connection with these various changes the old difficulty of the growth of stony incrustations in the boilers became aggravated rather than in any way diminished. As the only available remedy for this, there ensued the practical development and the very general introduction of the previously known but scarcely at all used principle of surface condensation instead of condensation by injection. A supply of distilled water from the condenser is thus maintained for feeding the boilers, and incrustations are avoided. The consumption of coal is often found now to be reduced to about 2 lbs. per indicated horse-power per hour, from having been 4 or 5 lbs. in good engines in times previous to about twenty years ago.

Before the times of ocean telegraph cables, very little had been done in deep-sea sounding; but when the laying of ocean cables came first to be contemplated, and when it came afterwards to be realised, the obtaining of numerous soundings became a matter of essential practical importance. In the ordinary practice of deep-sea sounding, as carried on, both before and since the times of ocean telegraph cables, until a year or two ago, a hempen rope or cord was used as the sounding line, and a very heavy sinker, usually weighing from two to four hundred-weight, was required to draw down the hempen line with sufficient speed, because the frictional resistance of the water to that large and rough line moving at any suitable speed was very great. The sinker could not be brought up again from great depths; and arrangements were provided, by means of a kind of trigger apparatus, so that when the bottom was reached the sinker was detached from the line and was left lying lost on the bottom; the line being drawn up without the sinker, but with only a tube, of no great weight, adapted for receiving and carrying away a specimen of the bottom. For the operation of drawing up the hempen line with this tube attached, steam power has been ordinarily used, and practically must be regarded as necessary.

A great improvement has within the last two or three years been devised and practically developed by Sir William Thomson. Instead of using a hempen sounding line, or a cord of any kind, he uses a single steel wire of the kind manufactured as pianoforte wire. He has devised a new machine for letting down into the sea the wire with its sinker, and for bringing both the wire and the sinker up again when the bottom has been reached. With his apparatus, in its earliest arrangement and before it had arrived at its present advanced condition of improvement, he sounded, in June 1872, in the Bay of Biscay, in a depth of 2,700 fathoms, or a little more than three miles, and brought up again his sinker of 30 lbs. weight, after it had touched the bottom; and brought up also an abundant specimen of ooze from the bottom, in a suitably arranged tube attached at the lower end of the sinker.

An important feature in his machine consists in a friction-brake arrangement, by which an exactly adjusted resistance can be applied to the drum or pulley which holds the wire coiled round its circumference, and which, on being allowed to revolve, lets the wire run off it down into the sea. The resistance is adjusted so as to be always less than enough to bear up the weight of the lead or iron sinker, together with the weight of the suspending wire, and more than enough to bear up the weight of the wire alone. Thus it results that the arrival of the sinker at the bottom is indicated very exactly on board the ship by the sudden cessation of the revolving motion of the drum from which the wire was unrolling.

Another novel feature of great importance consists in the introduction of an additional hauling-up drum or pulley arranged to act as an auxiliary to the main drum during the hauling-up process. The auxiliary drum has the wire passed once or twice round its circumference at the time of hauling up, and is turned by men so as to give to the wire extending from it into the sea most of the pull requisite for drawing it up out of the sea, and it passes the wire forward to the main drum, there to be rolled in coils, relieved from the severe pull of the wire and sinker hanging in the water. Thus the main drum is saved from being crushed or crumpled by the excessive inward pressure which would result from two or three thousand coils of very tight wire, if that drum unaided were required to do the whole work of hauling up the wire and sinker.

The wire, though exposed to the sea-water, is preserved against rust by being kept constantly, when out of use, either immersed in or moistened with caustic soda. The fact that steel and iron may be preserved from rust by alkali is well known to chemists, and is considered to result from the effect of the alkali in neutralising the carbonic acid contained in the water, as the carbonic acid appears to be the chief cause of the rusting of steel and iron.

This new method of sounding, depending on the use of pianoforte wire, was first publicly explained by Sir William Thomson in the Mechanical Section of the British Association at the Brighton meeting two years ago; and in the interval which has since elapsed, it has come rapidly into important practical use.

I have to-day already brought under your notice a system of elaborately contrived and extensively practised methods of signalling and otherwise arranging for the safety of trains in motion on railways. These methods, in the aggregate, as we have them at present, may be looked on as the result of a gradual development, which, through design and intelligent selection, has been taking place during the last twenty or thirty years, or more. In contrast with this I have now to mention a reform towards abatement of dangers at sea, which at present is only in an incipient stage of its practical application, but which I am sure must soon grow into one of the important reforms of the future. I refer to the provision of means whereby every important lighthouse shall, as soon as it is descried, not only make known to the navigator that a light is visible, but also that it shall give him the much more important information of what light it is; that, in fact, it shall distinguish itself to him from all other lights either stationed on land or carried by ships out at sea. The rendering of lighthouses each readily distinguishable from every other light, by rapid timed occultations, was urged on public attention by Charles Babbage about twenty or twenty-three years ago, in connection with a like proposal of his for telegraphic signalling by occulting lights. His admirable idea, however, so far as it related to the distinguishing of lighthouses, has unhappily been left almost entirely neglected until quite recently. Although I say it was almost entirely neglected, yet very important steps in the direction of the object proposed were taken many years ago by Messrs. Stevenson, engineers to the Commissioners of Northern Lights, and the flashing and intermittent lights introduced by them, and now used, although too sparingly, in various parts of the world, constituted a very great improvement in respect to distinctiveness. The first practical introduction of an intermittent extinction of a gaslight, which is a method now likely to become fruitful in important applications with further developments, was made many years ago by Mr. Wilson at Troon; and an admirable application of this plan by the Messrs. Stevenson to carry out the principle of rapid signalling is to be seen in the Ardrossan Harbour light, which is alternately visible for two seconds, and then for two seconds is so nearly extinguished as to be invisible. The whole period—four seconds—is, I suppose, the shortest of any lighthouse in the world. This light fulfils the condition of being known to be the light which it is, within five or ten seconds of its being first perceived; and thus, in respect to distinctiveness, I trust that I may without mistake say it is the best light in the world. Mr. John Wigham has succeeded in constructing large burners for the combustion of gas in lighthouses in general, including those of the first order, and embracing both fixed lights and revolving lights. He has also, in both these cases, applied with the most striking success the principle of occultation. Dr. Tyndall, in his reports to the Board of Trade, has dwelt frequently and emphatically on the ease with which gas lends itself to the individualisation of lights. By its application, he affirms that by simple arrangements it would be possible to make every lighthouse declare its own name. Within about the last two or three years the subject has been taken up energetically by Sir William Thomson. He has become strongly impressed with the enormous importance of the object in question. He has perseveringly laboured in making trials in various ways, both by the method of partially extinguishing gas flames and by the method of revolving screens; and I have pleasure in stating that, as a result of his efforts, a self-signalling apparatus is now constructed for the Belfast Harbour Commissioners, who are preparing to bring it into immediate use at the screw-pile lighthouse at the entrance of the harbour of Belfast. I shall not now enter on any description of this arrangement, as I understand that the apparatus, which has already been temporarily erected for trial in the lighthouse, and has shown good results, is to be exhibited and explained to this Section by Mr. Bottomley, who, as a member of the Board of Harbour Commissioners, has taken an active part in the promotion of the undertaking.

I wish next to make mention of the very remarkable works at present in progress in the harbour of Dublin, under the designs and under the charge of Mr. Bindon Stoney. In order to form quay walls with their foundations necessarily deep under water, he constructs on land gigantic blocks of artificial stone, or, as we may say, of concrete masonry, each of which is about 350 tons in weight, and which are accurately formed to a required shape. After the solidification of the concrete, he carries them away and deposits them on an accurately levelled bottom of sea, so that they fit closely together, and form so much of the quay wall in height as to reach above the low tide level; and so as to allow of the completion of the wall above by building in the usual manner by tidal work, and to allow of the whole structure being carried out without the use of coffer-dams. These operations are on a scale of magnitude far surpassing anything done before in the construction and moving of artificial stone blocks. They are carried out with machinery and other appliances for the removal and the placing of the blocks, and for other requirements of the undertaking, which are remarkable for boldness of conception and ingenuity of contrivance. The new methods of construction devised and applied in these works by Mr. Stoney are recognised as being admirably suited for the local circumstances of the site of the works in the harbour of Dublin, and their various arrangements form a very important extension of the methods of construction available to engineers for river and harbour works.

While progress has been made with gigantic strides in many directions, in engineering and in mechanics generally; while railways, steamboats, and electric telegraphs have extended their wonders to the most distant parts of the world; and while trade, with these aids, is bringing to our shores the produce even of the most distant places, to add to our comforts and our luxuries; yet, when we come to look to our homes, to the places where most of our population have to spend nearly the whole of their lives, I think we must find, with regret, that, in matters pertaining to the salubrity and general amenities of our towns and houses, as places for residence, due progress in improvement has not been made. Our house drainage arrangements are habitually disgracefully bad; and this I proclaim emphatically, alike in reference to the houses of the rich and the poor. We have got, since the early part of the present century, the benefit of the light of gas in our apartments; but we allow the pernicious products of combustion to gather in large quantities in the air we have to breathe; and in winter evenings we live with our heads in heated and vitiated air, while our feet are ventilated with a current of fresh, cold air, gliding along the floor towards the fire-place to be drawn uselessly up the chimney. A very few people have commenced to provide chimneys or flues to carry away the fumes of their more important gaslights, in like manner as we have chimneys for our ordinary fires. In mentioning this, however, as a suggestion of the course in which improvement ought to advance, I feel bound to offer a few words of caution against the introduction of flue pipes for the gas flames rashly, in such ways as to bring danger of their setting fire to the house. People have a strong tendency to require that such things as these should be concealed from view. In this case, however, special care should be taken against rashly placing them among the woodwork between the ceiling of the apartment and the floor of the room above or otherwise placing them in unsafe proximity to combustible materials. In many cases it would be better to place the flue exposed to view underneath the ceiling, and by introducing some accompanying ornamentation, to let the flue be regarded as a beneficent object not unpleasing to the eye.

The atmosphere of our large towns, where people live by hundreds of thousands all the year round, is not yet guarded against needless pollution by smoke, jealously, as it ought to be. Many of the wealthier inhabitants take refuge in living in the country, or in the suburbs of the town, as far away as they can from the most densely built and most smoky districts; but the great masses of the people, including many of all ranks, must live near their work, and for them at least greater exertions are due than have yet been made towards maintaining and improving the salubrity and the amenities of our towns. As to the abatement or prevention of smoke from the furnaces of steam-engines, the main requisites have long been very well known; but sufficient energy and determination have not yet been manifested towards securing their due application in practice. In too many cases futile plans have been tried, and on being soon abandoned have left a strong impression against the trying of more experiments; and this may account in part for the introduction of real improvements having been so slow. Smoke occurs when fresh coal is thrown suddenly, in too large quantity at once, upon a hot fire. By extreme care a fireman may throw coal into his furnace so gradually as to make very little smoke; but mechanical arrangements for introducing constantly and uniformly the new supply of fresh coal have been devised, and several of these have been such as to reduce the smoke emitted to almost nothing. I have seen in the neighbourhood of Glasgow, at a large manufacturing establishment at Thorniebank, one method which is applied to about thirty ordinary 40-horse-power boilers, in which upwards of 100 tons of coal are daily burned, and from the chimneys of which not more smoke is emitted than from many a kitchen fire. This method is under the patent of Messrs. Vicars, of Liverpool, and it seems to work very well. It has been about two years in work there. It was introduced at a time when coal was exceedingly high in price, as much to effect economy in fuel as to prevent smoke; and although the first cost was somewhere about 130*l.* per boiler, the proprietor considers himself to be already more than recouped for his outlay, as a saving of fully 12 per cent. in the fuel consumed was effected. At the same works I have also seen in operation the method of Messrs. Haworth and Horsfall, of Todmorden, which has, I am told, in certain circumstances, some advantages over the other. In this, as in the other, the coal is fed in uniformly by mechanical arrangements. The mechanism is different in the two cases, but the result in the motion communicated to the coal is very much alike in both. The bed of coal, which is gradually supplied in front, is caused to travel along the bars towards the inner end of the furnace, and the combustion proceeds in a very uniform manner in conditions highly favourable to economy of fuel, and without the emission of almost any visible smoke.

These two methods I have mentioned because they appear both to work very successfully in practice, while they both bring into effect the principle of action of the fuel which has long appeared to me to be the best that can be adopted for ordinary cases of steam-engine boilers.

I have now occupied, I think, enough of your time, and so I will conclude. I have endeavoured to select out of the wide range of subjects which fall within the scope of the Mechanical Section of the British Association, a few which have come more particularly under my own notice, and on which I thought it was in my power to give intelligence that might be interesting as to past progress, and suggestions that might be useful towards extension of improvements in the future.

SCIENTIFIC SERIALS

Archives des Sciences Physiques et Naturelles, No. 198.—M. C. Marignac contributes a paper On the simultaneous diffusion of certain salts, and gives long tables of the results of his experiments.—M. Marc Micheli gives a note of eighteen pages in length, On the Onagraceæ of Brazil, of which the greater part is taken up with the genus Jussiæa. He sums up the distribution thus:—

		N. America.	Mexico.	Antilles.	Guyane.	Pacific States.	Brazil.
Eujussieæa	23	1	2	5	7	7	22
Oligospermum	12	2	3	4	5	4	10
Macrocarpon	4	1	2	2	2	2	4
		4	7	11	14	13	36

—M. Maurice de Tribolet gives a concise history of the study of the genus Nerinæa, and gives analytical tables showing the distribution of species in the Jurassic beds of the Jura. The meteorological observations made at Geneva, under Prof. Plantamour, during May, conclude the number.

SOCIETIES AND ACADEMIES

PARIS

Academy of Sciences, Aug. 31.—M. Faye in the chair.—The following papers were read:—Astronomy at the Italian Spectroscopic Society, by M. Faye. This was a reply to some criticisms of P. Secchi. The author pointed out that P. Secchi's theory of sunspots was a return to the idea announced by Galileo in 1612, the clouds being buried in the body of the sun instead of floating above it. The theory advanced by the author on the other hand had been pronounced by Mr. Langley to be a *vera causa*. This *vera causa*, according to M. Faye, is nothing more than a law of hydrodynamic perfectly established for terrestrial air and water currents.—Remarks on the fish of the Algerian Sahara, by M. P. Gervais. The remarks refer to species of *Coptodon* and *Cyprinodon*, the former of which had been cited by M. Cosson as proving the continuity of the sheet of water which extended over this region. Note on the development of the contractile coat of the vessels, an anatomical paper by M. C. Rouget. New researches undertaken by the author on amphibian larvæ establish beyond doubt the contractibility of the ramified protoplasmic cells observed last year in the vessels of the hyaloid membrane of the adult frog.—On winged *Phylloxera* and its progeniture, by M. Balbiani. The author points out the complete analogy between *Phylloxera vastatrix* and the *Phylloxera* of the oak. New observations on the migrations of *Phylloxera* to the surface of the soil and on the effects of the method of submersion, a letter from M. G. Bazille to M. Dumas. The letter contained a note, published in the *Messager du Midi*.—M. P. Mouillefert addressed also a letter containing observations on the employment of the chief insecticides from experiments tried in the laboratory at Cognac and on the vines of the neighbourhood. M. P. Rohart addressed a letter on the action exercised by the soil on insecticide gases. Other communications relating to *Phylloxera* were received from MM. Delfan, A. Richard, Gauthier, L. Rousseau, &c.—On a physiological phenomenon produced by excess of imagination, a letter from M. P. Volpicelli to M. Chevreul. Two experiments were made with magnets upon nervous subjects, to see if the effects produced were really magnetic or due to the imagination. In the first experiment a piece of unmagnetised iron was shown to the patient, who immediately fell into convulsions. In the next experiment a magnet was placed in the hand of a nervous subject, who at the end of a few seconds became so over-excited that the magnet was removed. That the effect thus produced was due to the sight of the magnet was proved by hiding several powerful magnets in the chair occupied by the same individual, who when thus unconscious of their presence experienced no ill effect. M. Chevreul made some remarks *à propos* of the foregoing paper on certain other illusions, such as the divining pendulum and divining ring.—Remarks on recent researches concerning the explosion of powder, by MM. Roux and Sarrau. The authors pointed out the agreement between certain of the results obtained by them and by MM. Noble and Abel in their recent communications to the Academy.—New note on the tail of Coggia's Comet, by M. A. Barthélemy. The theory of a repulsive force emanating from the sun requires, according to the author, that the axis of the tail should always be a prolongation of the radius vector. With Coggia's Comet, however, as observed by M. Heiss on July 5, the tail made an angle of 160° with the radius vector. The facts appear to the author to be simply explicable by the hypothesis of an interplanetary medium submitted to the attractive action of the sun, through which medium the comet travels with an increasing velocity; fans and jets are supposed to be the result of the sun's attraction on the denser portions of the cometary matter.—On a new theory of the formation of comets and their tails, by M. Virlet d'Aoust. In 1835 the author suggested the hypothesis that comets were nascent stars—the internal and still incandescent portions shining through cracks in the dark surface. This view was afterwards abandoned for Saigey's hypothesis, which considered the tails of comets as the result of the reflection of their light on an atmosphere which they drew after them. This opinion was again modified to meet the researches of Weiss, Schiaparelli, Klinkerfues, and Oppolzer, who showed the connection between the comets of 1862 and 1866, of Biela and Pogson, and the annular meteor streams which give us the August and November shooting stars. The author then asked whether comets did not equally belong to rings which had given rise to their existence, and if the light emitted by their tails did not simply result from the reflection of light from the nucleus on to the cosmical particles which constituted the rings on which they seemed to depend. The recent researches upon Coggia's Comet confirm this view in the author's opinion.—On a new model of prism for direct vision spectroscopes, by M. J. G. Hofmann.—On some points in the anatomy of the common mussel (*Mytilus edulis*), by M. Ad. Sabatier.

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