THURSDAY, DECEMBER 26, 1895.

THE EVOLUTION OF ART.

Evolution in Art: as illustrated by the Life-histories of Designs. By Alfred C. Haddon, Professor of Zoology, Royal College of Science, Dublin. Pp. xviii + 364. (London: Walter Scott, Limited, 1895.)

THIS little book answers admirably to the idea of the Contemporary Science Series, of which it forms part, in being at once a work of original research and a popularisation of the subject. It is an example of the scientific method as applied to the history of art. That method, as cannot be too often repeated, consists essentially in patient accumulation of facts, and their classification according to their observed connections. The inferences which are drawn, after this process has been gone through, are trustworthy in direct ratio with the accuracy with which the facts have been observed and recorded and the extent of the area over which they have been collected.

The history of art is a most attractive subject; but until the last few years almost every thing written upon it had relation only to the art of very advanced communities, and for the most part only to a small department of that art. Hence little or no light was thrown upon the beginnings of human art; and only within limited provinces was any attempt made to trace its development and decay. The study of anthropology has effected a revolution in this, as in many other departments of thought. We now see that, as Prof. Haddon puts it, "in order to understand civilised art we must study barbaric art, and to elucidate this savage art must be investigated." We must, indeed, go back to the beginnings; or if we cannot literally do this, we must seek the earlier stages of art in circumstances as nearly akin as possible to those which first started it on its career. This is what Prof. Haddon has done. A biologist before he became an anthropologist, he brought to anthropological investigation a trained scientific sense. While on a zoological mission to Torres Straits he came in contact with the natives of the smaller islands, as well as of New Guinea itself, and was impressed with the exceeding interest of the anthropological data offered by tribes of savages as yet little corrupted by civilisation. Having both on the spot and, since his return, in the museums of Europe analysed and compared their artistic productions, he takes the art of this corner of the world as the point of departure for a larger inquiry. His investigations among the natives themselves enable him to speak with authority as to the meaning of their artistic motives, and to add the external witness of the people who produce the works to the internal witness of the works themselves. It was the generic differences between the art of one district in New Guinea and that of another district, which first drew his attention to the subject, and impressed upon him the truth on which he rightly insists that, in order to understand the art of any pattern, type, design, or motive whatever, its life-history must be studied; for every pattern, every type has a life-history, just as every species and every individual in the natural world has a life-history. And for this purpose every pattern and every type must be studied locally; that is to say, if the student be not actually on the spot, he must, in the first instance at least, confine his inquiries within the sphere of prevalence of the particular pattern he is studying, and not wander to different countries where similar patterns are to be found, which may spring from wholly different artistic motives.

Guided by these principles, the author begins by examining the decorative art of British New Guinea, dividing it into five regions, in which five several styles are respectively predominant. Of these, the materials at present available do not admit of a decisive opinion on the origin and motives of the art of the Fly River. The same observation applies to a great extent to the elaborate art of the Central District. In the other cases, the motives are seen to be a representation of some natural form, which becomes in course of frequent repetition degraded, until it assumes patterns where the original form is wholly unrecognisable without having the intermediate stages before the eye. The most interesting of these patterns are derivatives from the human face and from the head of the sacred frigate-bird.

Prof. Haddon then passes to a more general investigation of the material of which decorative patterns are made. He divides it into the decorative transformation and transference of artificial objects, and the decorative transformation of natural objects. In this chapter he is of course largely dependent upon the works of his predecessors; but he is able often to reinforce their conclusions from his own observations. In the following chapter he discusses the reasons which impel men to decorate objects. These he classifies into the æsthetic impulse, or desire for beauty; the desire to give information, including a summary account of the passage of picture-writing into alphabetical signs; the accumulation of wealth, by which objects originally of use, and therefore valuable, became through artistic treatment valueless for practical purposes, while they retained a more or less factitious value as symbols of wealth, and acquired at the same time an æsthetic value in consequence of the pains and skill spent upon them; and lastly, magical and religious motives. In this last section, Prof. Haddon's reputation as a student of folk-lore, or the psychological side of anthropology, gives his opinions great weight; and the conclusions of earlier inquirers, which his cautious reasoning leads him to support, must be regarded as, in the present state of our knowledge, established.

Finally, the author devotes a chapter to a full vindication of the scientific method of studying decorative art, and of his mode of procedure in the present volume. It cannot be said that the arrangement which places this chapter at the end is satisfactory. It would have been more logical to place the argument for the biological treatment of designs at the beginning; and it would, moreover, have saved some repetition, and have given a reader approaching the subject without previous scientific study of art, a preliminary grasp of the method adopted, and of the reasons for its adoption.

It is impossible here to do justice to Prof. Haddon's treatment of his subject. Although, as will be seen from

the foregoing analysis, his attention is mainly concentrated upon decorative art, the reasoning he has employed must apply to other kinds; and, indeed, he shows in the course of the volume many instances of such application. The number and interest of the questions he suggests, forbid discussion in the space at my command. The extent of ground covered necessitates dealing in a summary manner with certain portions of the field. It cannot be helped. In a work of this kind it is more important to give glimpses of results beyond those actually worked out, than it is to establish a number of conclusions in detail. Prof. Haddon is fully alive to this; and while his conclusions, as far as they go, are in the main sound, and his exposition is clear and forcible, to fulfil the more important office he voluntarily foregoes much that would have added interest in the eyes of specialists, and perhaps in the eyes of others also. For the student every page will have its own suggestions. That humbler, but much more formidable, person, the general reader, for whom the book is also intended, if he be unacquainted with the writings of Holmes, Balfour, Dr. Colley March, and Count Goblet d'Alviella, will find himself in a new world. He cannot have a more trustworthy and companionable guide, with whom to commence its exploration, than Prof. Haddon.

Most of the figures are well and clearly reproduced; but a few of them would be greatly improved by the adoption of a larger scale. Some, such as the bamboo-pipes in Fig. 1, and Buddha's footprint in Fig. 130, are almost useless, on account of their diminutive size as compared with the intricacy of their patterns.

E. SIDNEY HARTLAND.

THE FLORA OF BOURBON.

Flore de l'Ile de la Réunion [Bourbon] . . . avec l'Indication des Propriétés Économiques et Industrielles des Plantes. Par E. Jacob de Cordemoy. (Paris: 1895.)

THE appearance of Dr. Cordemoy's long-promised book on the flora of Bourbon will be welcomed with great satisfaction, as this was the only island of the Mascarene group proper of which the plants had not been worked out in detail. Dr. Cordemoy's work is not compiled on the same lines as the British Colonial Floras, and in some respects compares unfavourably with them; notably in the want of uniformity in treatment, and the absence of particulars of the general distribution of the plants. But the author has laboured under the great disadvantage of being remote from a botanical centre of literature and collections, and has done exceedingly well considering these drawbacks, except that, with his thirty-five years of experience, he might have given a much more interesting account of the vegetation, and a better summary of the facts brought to light by his investigations.

Mauritius and Bourbon, separated by about 100 miles, are nearly of the same extent; but the mountains of the latter rise to an altitude of nearly 9500 feet, or upwards of 6000 feet higher than those of Mauritius. This additional elevation adds a zone of vegetation to Bourbon which is practically unrepresented in Mauritius; yet there is no strictly Alpine element in the flora, and the presence of native species of such genera as *Ranunculus Stellaria*, and *Hypericum* hardly marks a cold climate. Perhaps the most striking thing in the flora of the two islands is the large number of characteristic genera and species common to both. For example, the indigenous palms of Bourbon are: *Hyophorbe indica*, *Dictyosperma alba*, *Acanthophœnix rubra*, *A. crinita*, and *Latania Commersonii*. These are also, all of them, indigenous in Mauritius, and nowhere also. This is a strong contrast to the strictly endemic palm-vegetation of the Seychelles. On the other hand, Bourbon possesses a bamboo, *Nastus borbonicus*, which covers extensive areas at 4250 to 6500 feet, growing to a height of 35 to 50 feet. Excluding *Pandanus utilis*, four species of screw-pine are described; all endemic, and evidently constituting a prominent feature in the landscape, both on the seashore and high up on the mountains.

Other genera and species common and restricted to the two islands are: *Cossignia pinnata* (Sapindaceæ), *Grangeria borbonica* (Rosaceæ), and *Psiloxylon mauritianum* (Lythrarieæ?).

Among characteristic genera largely developed in both islands are *Dombeya* (Malvaceæ), *Quivisia* (Meliaceæ), and the shrubby *Psiadia* (Compositæ). Among mountain shrubs of wide distribution within the African region, *Phylica nitida* and *Agauria salicifolia* are noteworthy. The former Cordemoy describes as a new species, with the remark that it may be the same as *P. mauritiana*. I have elsewhere[1] given my reasons, supported by the opinion of previous writers, for uniting the forms of *Phylica* inhabiting the Tristan da Cunha group, Amsterdam Island, Bourbon, and Mauritius under one species; and a further examination of the specimens does not alter that conviction. *Agauria salicifolia* is a common shrub on the mountains of Mauritius, Madagascar, and Continental Africa, westward to the Cameroons.

The discovery in Bourbon of *Bryodes micrantha* (Scrophularineæ) is interesting. It is a minute plant, only known at Kew from the one small specimen on which the genus was founded, collected in Mauritius by Bojer.

Hydnora africana, a root-parasite, found in some districts of South Africa, is recorded as common at Saint Paul, and as being known under the name of *Rose de Noël*. This is even more remarkable than the discovery of a new species of *Cytinus* in Madagascar.

As in Mauritius, so in Bourbon, gymnosperms are wholly wanting in the native and naturalised flora; and at present only one species each of *Podocarpus* and *Cycas* is known to inhabit Madagascar. They are both endemic. The phyllodineous *Acacia* (*A. heterophylla*), which has lately been recorded as introduced in Madagascar, and which is so near the Sandwich Islands *A. Koa*, as to be hardly distinguishable, if you did not know where your specimens came from, is said to be very common on the mountains, between about 3250 and 6500 feet. It is also common in Mauritius, and apparently undoubtedly native.

With regard to the total number of indigenous species of vascular plants, as compared with that of Mauritius, it is not easy to arrive at a satisfactory estimate, because many of the plants now commonest were probably introduced; but 1000 is, perhaps, below the actual number,

[1] "Botany of the *Challenger* Expedition," i. 2, p. 148.

as against 850 in Mauritius. The larger number may be accounted for by the greater elevation of Bourbon, as well as the divergencies in the numerical representation of the predominating natural orders. Some fourteen fewer natural orders are represented in Bourbon, but, in return, several orders are much more numerously represented.

It was known that Bourbon, as well as Mauritius, was exceedingly rich in ferns and orchids; yet few botanists will be prepared for the fact that orchids outnumber the two next highest orders combined. Orchids are absent or very rare in small remote islands, and comparatively rare in larger ones where there is a humid climate and rich vegetation; or even absent, Juan Fernandez, for example; and British India is the only large continental area, so far as I am aware, in which orchids predominate over any other order. Nearly 20 per cent. of the flowering plants of Bourbon are orchids; the total number described being 172 species, and the author expresses a doubt whether this is exhaustive. Three new genera are proposed, one, *Hemiperis*, comprising twenty-one species. Altogether seventy-two are described as new, and they are about half epiphytic and half terrestrial. Very few of these orchids are represented in the herbaria of this country, and, indeed, many of the other endemic plants of the island, especially the inconspicuous ones.

Dr. Cordemoy describes three or four new genera belonging to other orders, but mostly from somewhat imperfect materials. The most interesting is a labiate (*Mahya stellata*), supposed to be the only really indigenous member of the order, and exceedingly rare, being found only on the summit of the Grand Benard, at about 8500 feet. W. BOTTING HEMSLEY.

TECHNICAL EDUCATION.

The New Technical Educator. Vols v. and vi. (London, Paris, and Melbourne: Cassell and Co., Limited, 1895).

THESE are the concluding volumes of a valuable series of treatises on various technical subjects; the previous ones have already been noted in our columns. All the subjects are dealt with in an admirable manner, the author in each case being a specialist. The arrangement of the work is such that in most cases each volume contains information bearing upon a particular subject. A good index has been placed at the end of the last volume, and this very materially adds to the value of the work.

Prof. W. H. Greenwood's treatment of the manufacture of "Steel and Iron" is excellent. Commencing with the ores, he takes the reader through all the many processes in vogue, with ample illustrations and descriptions. The question of tests, however, appears to be generally overlooked. This is unfortunate, because it is of great importance both to the manufacturer and the engineer. In all modern specifications the quality of the material to be used is always stated, either in the form of mechanical or chemical tests.

Another well-written section is that on "the Steam Engine," by Archibald Sharp. In this case, also, the subject has been thoroughly dealt with from the beginning. The illustrations and descriptions are of recent engines, and boilers. Of the latter, the water-tube type has not been overlooked; more might have been said, however, on the subject. The locomotive is represented by one of Mr. Worsdell's compounds, and we are told that "compound locomotives are being largely used." This statement is scarcely correct, because in this country, at any rate, they are at a discount. The same author has much to say on the subject of "Gas and Oil Engines." He omits to describe the porcelain ignition tubes now largely used in place of iron.

On "Engineering Workshop Practice," by several authors, we find much general information dealing with the engineering trades. Taken as a whole, the treatment flavours more of the amateur than of the tradesman. The same cannot be said of "Electrical Engineering," by Edward A. O'Keeffe, because this subject occupies a prominent position in these volumes, having been particularly well written throughout. The last two volumes treat more particularly of the construction of incandescent lamps, accumulators and measuring instruments, concluding with descriptions of the microphone, telephone and phonograph, besides sundry details.

"Civil Engineering" has also been creditably treated from all points of view, the construction of roads naturally coming much to the front, and the praises of Telford and Macadam duly sung. An interesting account is included on the rise and progress of railways; when discussing probable speeds, we read: "The desire is now for higher speeds, and as much as 250 miles per hour is projected." This statement is far-fetched, and should have been omitted. The table giving train resistances, on p. 175, vol. v., would have been of more value had the authority been quoted. Further on, permanent way is discussed, and we are informed that "sleepers are never placed under the fish-joints." This statement is not correct. Another inaccuracy is found on page 297, where we read "that the driving-wheels of some locomotives have as much as twenty-five tons on them"; even the Great Northern people would probably plead "not guilty" to twenty tons on the driving-wheels of their famous single engines. Much useful information has been brought together under the heads of hydraulics, pumping machinery, lighthouses, ships, &c.

The "Dyeing of Textile Fabrics" is fully discussed, the author being Prof. J. J. Hummel, of the Yorkshire College; treated very much from a chemical point of view, dyers will find much to learn on this subject. In answer to the question, "What is technical education?" we find some sound remarks from the pen of Mr. Henry Cunynghame. He observes that the use of a knowledge of principles, as compared with the mere routine of the workshop, cannot be overrated; this is the distinguishing feature of the true mechanic from the factory hand. Much has been done of late years to encourage the formation of technical schools; but more must be done if we are to retain our present position as a manufacturing country. A knowledge of principles, both mechanical and chemical, is all-important; and these, in conjunction with machinery of the latest design, must surely tell in the race for trade.

The volumes before us will be of much use to those

wishing to study any of the subjects dealt with in this "Encyclopædia of Technical Education." The treatment is thorough, the illustrations numerous, and the printing good. N. J. L.

OUR BOOK SHELF.

A Laboratory Course in Experimental Physics. By W. J. Loudon, B.A., Demonstrator in Physics in the University of Toronto, and J. C. McLennan, B.A., Assistant Demonstrator in Physics in the University of Toronto. Pp. vi + 302. (New York and London: Macmillan and Co., 1895.)

THIS book, the authors tell us in the preface, is the outcome of their own experience, and is intended, in the first instance, to be used by the students at the University of Toronto, and the hope is expressed that it will be appreciated by those engaged in teaching experimental physics elsewhere.

The book is divided into two parts. Part i. is devoted to the description of elementary apparatus and elementary methods of performing simple experiments in mechanics, light, photometry, and heat. In this part students are only expected to be acquainted with the elements of algebra and trigonometry. On p. 55 is given a very neat elementary proof of the fact that the deviation of a ray of light passing through a prism is a minimum when its direction is symmetrical with respect to the refracting surfaces. We think that, considering how elementary this part is, the explanations might at times be simpler. It is not wise to indulge too frequently in such expressions as "it can be readily seen," even in matter intended for advanced students; and teachers cannot be too lucid when dealing with beginners.

Part ii. is intended for advanced students, and contains directions for experiments in acoustics, heat, electricity, and magnetism, with an appendix on the determination of gravity and on the torsion pendulum. The theory of the various experiments is given, and demands a wider mathematical knowledge, *e.g.* the laws of the transverse vibrations of strings are deduced from the equations of motion. A striking omission in this part is the little attention which is given to the corrections which have to be applied when making most accurate physical measurements.

The choice of experiments is good, the theory and descriptions of the apparatus are accurate, and the illustrations are clear. The division into elementary and advanced is not apt, as many of the experiments in Part ii. would be more suitably placed in Part i. This, however, is not a serious defect, as teachers using the book can arrange the order of the experiments to suit themselves. We certainly think that students of physics should become acquainted with the simpler electrical experiments as early as possible.

The book is well got up, and its value is greatly enhanced by the tables of physical constants at the end. We heartily recommend the work to teachers of practical physics as containing very good matter, and being accurate and free from misprints. W. G. RHODES.

The Natural History of "Eristalis tenax," or the Drone-fly. By G. B. Buckton, F.R.S. Pp. iv + 92. With illustrations. (London: Macmillan and Co., 1895.)

THE author's solid contributions to more than one branch of science may well protect him from criticism of extreme severity, but it is our duty to remark that this is not an adequate account of the drone-fly. The subject is a particularly good one. The drone-fly is very common, large for a dipterous insect, and distinguished by many interesting peculiarities of structure and habit. But the author has not realised how much work goes to the production of an exact and thorough monograph. Such a monograph demands minute investigation of the anatomy of every stage, comparison with some few allies at least, and much patient observation of the living insect. Mr. Buckton has not worked out the anatomy of the drone-fly in any stage, as the vague figures testify. Some important and very peculiar features of the larva are passed over without mention. There is no effective comparison with other insects. The habits of the larva and the fly have been attended to, and the account of the mode of life of the fly contains the only valuable facts in the book. There is much matter concerning insects in general, but this is not always either trustworthy or pertinent. Sometimes facts and theories are cited, not from the original memoirs, but from any author who happened to be at hand. Weismann on *Corethra* is quoted from Balfour, Johnston on *Culex* from Riley, Müller on mosaic vision from Mallock. The danger of this practice is illustrated by the last case, where Mr. Buckton shows that he is not fully possessed of the theory of mosaic vision. It may be useful to remark that the larvæ and egg-chains mentioned on page 19 probably belong to the very familiar *Chironomus*. The drone-fly has been studied by our author as a hobby, and he has no doubt got much pleasure out of it; but a more serious attack should be made upon it before long. L. C. M.

Working Models for Engineering Students. Engine Slide-Valves. Designed by Messrs. T. Jones, M.I.Mech.E., and T. G. Jones, B.Sc. Second edition. (Manchester: John Heywood, 1895.)

TO obtain a thorough insight into the movements of slide-valves, and to completely understand the distribution of steam, is generally a difficult matter to first-year students and engineering apprentices. These models, however, should greatly assist all who study the subject; they are neatly printed on cardboard, the important parts are sectioned and tinted, and the valves are movable so as to show their positions when the piston is at any part of the stroke. The relative positions of crank-pins and eccentrics are clearly shown, as well as the valves and steam-ports. The models are of a convenient size, being six inches long by four inches wide, and they represent eight different kinds of slide-valves. As such models must be absolutely accurate from a mechanical point of view to be of use to technical students, we must point out that No. 1 is said to represent a slide-valve common in locomotive practice; but the valve spindle is shown passing through the valve, whereas valve buckles are always used. No. 2 is a single-acting piston valve for a steam hammer. If it is considered necessary in this case to show the piston and rod, why not do it accurately? The parts shown do not represent a steam-hammer piston and part of the rod.

Model No. 5 represents a partly-balanced ordinary slide-valve. The authors omit to say that the space inside the relief ring must be open to the exhaust cavity to allow any steam leaking past the ring to escape, otherwise it would be of no good. This type of valve is now being largely used for locomotive purposes. The same defect is to be found in model No. 7.

Taken as a whole, the models are very useful for the purpose of illustration; they will be of much value to students and others interested in the subject.

Macmillan's Geography Readers. Book vii. Pp. 240. (London: Macmillan and Co., 1895).

IN this little Reader for elementary schools, instructive descriptions are given of the chief places and objects of interest to be seen in a journey through the United States; and the main historical facts concerning the New World are woven into the lessons, to give them additional brightness. The book also contains sections on ocean currents and tides, and is well illustrated; while the numerous extracts from the writings of travellers, give a good idea of the conditions and characteristics of American people.

LETTERS TO THE EDITOR.

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

The Bury St. Edmunds Human Skull Fragment.

IN 1884 the late Mr. Henry Prigg, of Bury, exhibited before the Anthropological Institute a portion of a human skull supposed to be of Palæolithic age. The paper was printed, with an illustration from my pencil, in the *Journal* of the Anthropological Institute, vol. xiv. p. 51. The relic was found in 1882, in the parish of Westley, in brick-earth at a depth of 7½ feet. Mr. Prigg was in the pit on the morning after the discovery, and could see no traces of a grave, or old disturbance. A few yards from the pit mentioned, a workman reported the discovery of an entire human skeleton in the brick-earth, at a depth of 8 feet, some thirty years previously.

FIG. 1.—View of left side of the Bury skull fragment placed over the contou of Spy skull No. 2. Half natura size

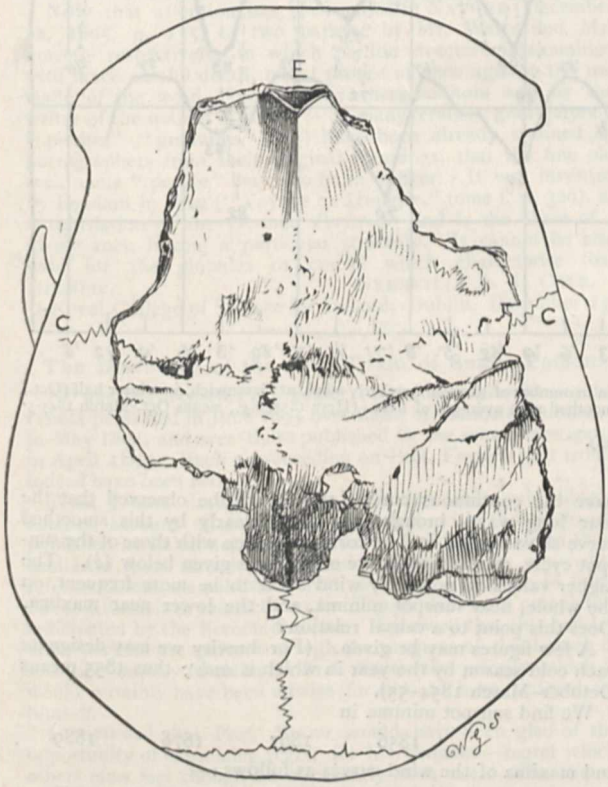


FIG. 2.—Inferior surface of Bury skull fragment placed over the sutures of Spy skull No. 2. Half natural size.

Mr. Prigg in his paper gives the briefest possible description of the skull fragment, which consists of a considerable part of a frontal bone with five inches of the coronal and a little over two inches of the sagittal sutures, and an anterior third of the left parietal bone, and a small anterior portion of the right. At the time when Mr. Prigg's paper was read, the Spy crania had not been discovered.

When the Bury fragment was in my possession in 1884, for illustration, I carefully drew not only the plate published, but the left side and inferior surface. These two illustrations have remained in my possession, and are now photographically reproduced for the first time to one-half the natural size.

The coronal suture is very clearly seen in the left side view (Fig. 1, A A). The upper A shows the point of junction of the coronal with the sagittal. This point is also well marked in the Spy skull No. 2, as well as the line of descent to the lower A. If the point of junction of the two sutures is taken as a fixed position, the close agreement of the line of descent of the sutures and the contour of the two skulls is remarkable. The Bury contour and suture is shown by solid lines, and the contour and suture of the Spy skull by dotted lines. The point B shows the inner plate of the frontal sinus, and indicates the near position of the ophyron and supraorbital prominences on the outer plate.

A comparison of the inner surface of the Bury fragment is equally confirmatory of its affinity with the Spy form. In Fig. 2, the junction of the coronal with the sagittal suture is again used as a fixed point, and the line of the coronal at C C is determined by the line of the sagittal at D. It will be seen by the illustration that the course of the coronal towards the right and left temporal bones is identical in the two examples. Part of the glabella showing the two plates of bone and air chamber is shown at E.

The mere identity of the course of the sutures is not of much importance; but the interesting point is, that when the sutures are taken as fixed guides for putting the Bury fragment in a natural position, the Spy contour results.

Dunstable. WORTHINGTON G. SMITH.

The Coronal Rays of Passion-flowers.

THE filaments, or rays, forming the corona of Passion-flowers are structures of much interest. In 1790, Sowerby described them in *Passiflora cærulea* as a "double row of horizontal, thread-like, radiated nectaries." His subsequent remarks, however, do not assure us that he regarded them as glandular, or as nectaries as we now define them. In Dr. Masters' "Contributions to the Natural History of the Passifloraceæ" (*Trans. Linn. Soc.* xvii.) no mention is made of distinct glandular structure, but Morren's opinion is quoted that "the corona is the seat of the perfume of the flower in *Passiflora quadrangularis*—a fact which he considers proved by the anatomical structure of the coronal threads, as also by the circumstance that if the processes in question be early removed the flowers remain scentless. In repeating this experiment, however," continues Dr. Masters, "I have not been able to satisfy myself of the absolute correctness of this statement. . . . Prof. Morren attributes to the conical pimple-like cells of the epidermis of the coronal filaments the formation of the odoriferous principle. These peculiar cells are found on the surface of the petals, and in the nectariferous portion of the tube of the flower. . . . We must await further evidence before we assume that in the Passion-flowers these cells really secrete the odorant principle." In Vines' "Students' Text-book," recently published, an emphatic statement is made that the coronal rays "are not glandular."

I have not yet had opportunity of studying *P. quadrangularis*, but a strongly and rather pleasantly scented hybrid, named *P. Buonapartea*, the parentage of which is stated to be *P. alata* × *P. quadrangularis*, has been under careful observation. In it the rays bear an apical tuft of glands, visible to the naked eye as a whitish knob. When magnified the glands are multicellular, relatively large, and in form remind one of those found in *Rubiaceæ*. The rays of the common *P. cærulea* are devoid of

apical glands, and the odour of the flower is rather weak, and very disagreeable. In a cross of my own raising, the parentage being *P. Buonapartea* × *P. cærulea*, the flower is delightfully odoriferous, and the rays are tipped with glands, about half as well developed as those of the former (the seed) parent. That such is the case points to the possibility of the terminal cells of the rays of such as *P. cærulea* being glandular in function in some degree. The general structure of the ray is the same in all, in respect of having conical epidermal cells, spiral vessels running up to the apex, and bearing, besides numerous conglomerate crystals, so great a number of minute starch granules as to render portions often almost black when treated with iodine.

It was repeatedly proved that the perfume of my variety was located in the rays—presumably the apices. It is singular that certain hybrids studied, stated to be between *P. alata* and *P. cærulea*, *e.g. Impératrice Eugénie*, do not bear any coronal glands, for it seems likely from analogy (flowers not yet having been observed) that *P. alata* should possess them; one being tempted to assume that species with long filaments at about right angles to the corolla will be found to bear glands, while those with shorter ones, lying at a small angle with the corolla, will not.

JOHN H. WILSON.

Yorkshire College, December 12.

Colours of Mother-o'-Pearl.

IN your issue of October 24, Mr. C. E. Benham calls attention to the fact that the colours of mother-o'-pearl cannot be due to the striations on the surface, as originally explained by Brewster. I have recently communicated a paper to the *Geological Magazine*, June 1895, in which I came to the same conclusion, and also found it impossible to accept the lamina theory as stated by Mr. Benham, for the following reasons. In certain fossilised shells, notably those of the Ammonites, the conchiolin of the shell has in course of time disappeared, and there remains not the lamina, but the prismatic structure; hence I concluded that the latter was the fundamental form in which the calcite of the shell was deposited. In *Am. Ibex*, *Elisabethæ*, &c., the shell has a chalky appearance, consisting of the detached prisms which can easily be separated by rubbing; but when the shell is carefully soaked in Canada Balsam the interspaces become filled up with the resin as they were in life, and the play of colours is perfectly reproduced. Where the original calcite has been replaced by some other mineral, such as silica or marcasite, as exemplified in the Blackdown and Gault Ammonites, it is not the lamina, but the prismatic structure that is reproduced, and in both cases the play of colours is similar to that of the original shell. In Meleagrina, whence the ordinary mother-o'-pearl is derived, the prisms of the shell are not so regular as those in the Ammonites, but the cause of the colour is the same. The laminæ of shell material, though very thin, are hardly thin enough to produce the phenomenon as Mr. Benham would have it. A full description of these prisms, and the way they affect light, is given in the paper above referred to.

ERNEST H. L. SCHWARZ.

Cape Town, November 14.

I AM indebted to you for giving me the opportunity of a remark on Mr. Schwarz's letter. Interesting and valuable though his researches were, the argument, as stated in the paper to which he refers, did not carry conviction to me. To deduce from fossils, in which secondary changes of mineralisation have admittedly taken place, conclusions as to the minute histology of recent shells, seems precarious. The connection between the prisms and the experimentally produced iridescence is not clearly proved; and the explanation of the supposed connection is based on a purely hypothetical arrangement of calcite crystals, such as mineralogists consider highly improbable. It is not proved that the iridescence experimentally produced in the fossils is the same as that occurring in a recent shell. As for Mr. Schwarz's new objection, that the laminæ are not thin enough to produce the phenomenon, this is certainly true for the calcite laminæ, and is equally fatal to Mr. Schwarz's own explanation; but some of the conchiolin laminæ are far thinner than the calcite, and might well produce interference in the light reflected from their upper and under surfaces.

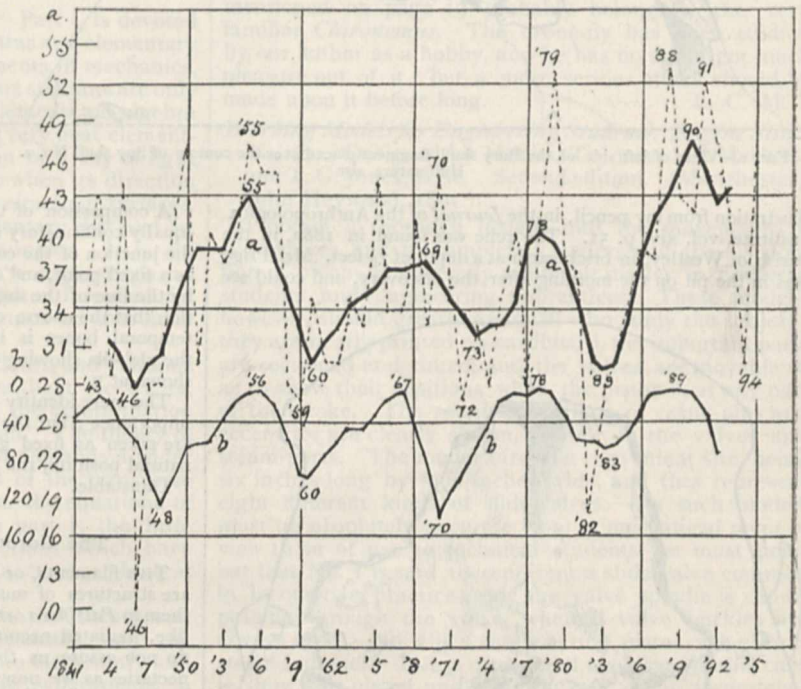
F. A. BATHER.

December 12.

Northerly Wind in Winter Seasons.

THE recent variations of northerly wind at Greenwich in a series of the cold seasons October to March (the winds being reduced to the four cardinal points) present some interesting features, to which I would invite attention.

These variations, since 1841, are exhibited in the dotted curve of the diagram (the ordinate figures expressing days); and a smoothing process having been applied (averages of five), we have the continuous curve (*a*). It will be observed that the four long waves brought out more clearly by this smoothed curve show a good deal of correspondence with those of the sunspot cycle, an *inverted* curve of which is given below (*b*). The higher values of northerly wind seem to be more frequent, on the whole, near sunspot minima, and the lower near maxima. Does this point to a causal relation?



(*a*) Dotted curve, variation in number of days of northerly wind, at Greenwich, in winter half (Oct., March); continuous curve, smoothed with averages of five. (Here 1855, *e.g.*, means Oct.-March 1845-5- &c.)

(*b*) Sunspot curve (inverted).

A few figures may be given. (For brevity we may designate each cold season by the year in which it *ends*; thus 1855 means October-March 1854-55).

We find sunspot minima in

	1856	1867	1878	1889

and maxima of the wind curves as follows:—

Unsmoothed curve	1855 (47)	1870 (45)	1879 (53)	1888 (53)
Smoothed curve	1855 (43·0)	1869 (37·8)	1878 (40·0)	1890 (47·4)

On the other hand we find sunspot maxima in

1848	1860	870.	1883	1893

and minima of the wind curves in

Unsmoothed curve	1846 (10)	1859 (27)	1872 (27)	1882 (18)	1894 (?) (30)
Smoothed curve	1846 (27·8)	1860 (30·0)	1873 (31·8)	1883 (29·4)	

The high value for our last cold season strikes one as a little anomalous, causing an unusual break in the smoothed curve, if we suppose (as we perhaps may) that this curve has not yet reached its lowest point before rising to the next maximum (say) about 1901.

It would appear, then, that in the period considered, the northerly type of weather, in which we are generally on the eastern border of an anticyclone, has been specially prevalent about the time of minimum sunspots, giving way to some other type or types in the interval.

A careful study of the behaviour (movements of translation, of contraction and expansion, &c.) of those high and low pressure systems which determine the direction of wind, and furnish our weather generally, seems likely, in the future, to throw some useful light on the nature of solar influence on our atmosphere. In this connection, I may refer to the work of the American meteorologist, Prof. Bigelow, who finds (*Am. Journal of Science*, vol. xlviii. p. 445), that in North America, "the North Low [pressure] and the South High [pressure] belts vary in latitude directly with the solar intensity, being further north at the maximum, and further south at the minimum of the period; while the North High and the South Low belts vary inversely, that is, are further south during the maximum of sunspots."

We know that northerly wind generally means cold, and it would be interesting to trace the effects of the apparently cyclical variation in those winds, above indicated, on health and other matters. A. B. M.

"Perlites."

NOW that attention has been called in NATURE (December 12, 1895, p. 135) to two papers, by Mr. Watts and Mr. Smeeth respectively, in which perlitic structure is examined with much careful detail, may I protest at once against the use made of the word "perlite" by these authors and by the writer of the note in NATURE? So many terms ("granophyre," "picrite," "granulite," &c.) have been already strained by petrographers from their original meanings, that the fine old rock-name "perlite" may also be in danger. It was invented by Beudant in 1822 ("Voyage en Hongrie," tome i. p. 329), as a translation of the German *Perlstein*, and is the name of a glassy rock having a particular structure. It cannot be also used for the globules or cracks which characterise that structure. GRENVILLE A. J. COLE.

Royal College of Science for Ireland, Dublin, December 13.

The Discovery of the Anti-Toxin of Snake-Poison.

NO one has accused Prof. Fraser of claiming priority for his results published in June 1895 over those of Calmette published in May 1894, and over those published by the same investigator in April 1895. Such a proceeding on Prof. Fraser's part would indeed have been rash.

What I have drawn attention to is that when publishing a detailed account of experiments identical with those already published by Calmette, and when drawing conclusions from them similar to those already formulated by Calmette, he omitted to refer to Calmette's published work *in such a way* as to fairly direct attention to the fact that he (Fraser) had been completely anticipated by the French observer. I showed that this had led other persons not conversant with the progress of this branch of scientific inquiry to claim for Prof. Fraser the priority which it would certainly have been unwise for him to have claimed for himself.

I supposed that Prof. Fraser would have been glad of the opportunity of expressing regret for his omission—regret which others must feel though he apparently does not. The theory put forward by Prof. Fraser that it is not usual in communications to the Proceedings of a scientific society *extending to twenty-seven pages octavo in length*, to give more than the very briefest allusion to the latest work on the subject carried out and published by another worker and anticipating all that you have to say, is not, I think, admissible. Especially, it seems to me, is it unusual that the reference to an immediate predecessor's work should be so brief as to appear contemptuous, and so expressed as to be actually misleading (even when read by experts) in regard to the total absence of novelty in the experiments and conclusions which you are about to record as your own work.

Prof. Fraser read one paper to the Royal Society of Edinburgh on June 3, and a second on the same subject on July 15. It is impossible to imagine how many such preliminary statements Prof. Fraser would consider it right to publish, and how long a time he would allow to lapse before making the statement which one would have thought should have been preliminary to them all, viz. that the experiments have been already made, and the results published by Calmette.

London, December 22. E. RAY LANKESTER.

Male of Apus.

THE male individuals of *Apus cancriformis* are so rare, that it appears worth while recording the occurrence of one amongst the specimens used in the Zoological Laboratory in Oxford, during the ordinary course of our work. As Kozubowski showed in 1857, the only external sexual difference is the absence in the male of the egg-sac on the sixteenth appendage, known as the oostegopod of the female. This limb in the male is quite similar to its neighbours: there are no appendages modified for holding the female, such as occur in the allied form, *Branchipus*. It is generally stated that the male of *A. cancriformis* is about one-third the size of the female; whilst Lubbock found that the male of *Lepidurus productus* is larger than the female. The present male did not differ in size from the females; some of which were slightly larger, others smaller.

Oxford, December 18. W. B. BENHAM.

The Merjelen Lake.

IT may help Dr. Du Riche Preller to a precise knowledge of the condition of the Merjelen See, prior to the last *débâcle*, to inform him that on August 3 of the present year the water-level was about 60 feet below the strand-line marking the level of the col by which the lake drained into the Viesch valley. There was at that time an upper as well as a lower lake.

I have a number of photographs which show different aspects of the lake, and I do not doubt but that fairly accurate determinations of the water-level could be obtained from them.

PERCY F. KENDALL.

The Yorkshire College, Leeds, December 17.

THE PARIS ACADEMY OF SCIENCES AND THE ROYAL SOCIETY.

AT the recent anniversary meeting of the Royal Society, M. Marey, the President of the Paris Academy of Sciences, attended in his official capacity. Upon returning to France, he gave an account of his visit, and his remarks are reported in full in the *Comptes rendus* of the meeting of the Academy on December 9. The pleasant relations that exist between the Royal Society and the Paris Academy furnish standing evidence of the truth that the interests of science are international, and M. Marey's remarks on the work in connection with the Catalogue of Scientific Papers show how closely those who are devoted to the advancement of scientific knowledge are bound together. His visit is the visible sign of the kindred feeling which prevails among French and British men of science. In October last, many of our leading workers in science, art, and literature were the honoured guests of the Institute of France, and we may regard the return visit of the President of the Academy of Sciences to the Royal Society as an official expression of appreciation. It is on this account, and because the visit was a matter of unique consequence, that we print literally M. Marey's address to the Paris Academy.

"Je dois rendre compte à l'Académie, des résultats d'une mission que je viens de remplir en Angleterre. La Société Royale de Londres m'avait invité, à titre de Président en exercice de votre Compagnie, à assister aux fêtes anniversaires de sa fondation.

"C'est donc à notre Académie que s'adressait l'accueil si honorable qui m'a été fait à Londres. J'y ai entendu le Prési-

dent sortant, Lord Kelvin, et le nouveau Président, Sir J. Lister, exprimer les liens d'estime, de reconnaissance et d'amitié qui les attachent aux savants français. Dans presque tous les discours qui ont été prononcés, des paroles émues témoignaient de l'admiration que nos voisins professent pour notre regretté Pasteur.

"Je crois avoir été le fidèle interprète des sentiments qui nous animent tous en assurant les membres de la Société Royale de notre estime et de notre sympathie et en rappelant combien nous avons été touchés de l'empressement avec lequel nos Confrères et nos Correspondants anglais sont venus célébrer les fêtes du Centenaire de l'Institut de France.

"Un autre motif encore m'avait valu l'honneur d'être invité par la Société Royale. Cette savante Compagnie entreprend un travail d'une haute importance pour la Science ; il s'agit de la création d'un grand Catalogue international, rassemblant tous les travaux publiés chaque année dans le monde entier sur toutes les branches de la Science.

"La plupart de nos Confrères connaissent déjà le magnifique Ouvrage dans lequel la Société Royale a rassemblé, sous le nom de chaque auteur, les titres des travaux publiés en tous pays depuis l'année 1800 jusqu'à nos jours. Chacun peut trouver, dans ce Recueil, la série de ses propres publications : Livres, Mémoires et jusqu'aux moindres Notes y sont classés par ordre chronologique, avec indication précise du titre et de la date de leur impression. Mais un tel Recueil, excellent lorsqu'il s'agit de retrouver les travaux successifs d'un auteur, se prête mal aux recherches bibliographiques sur un sujet donné. C'est pour combler cette lacune que la Société Royale veut entreprendre l'œuvre colossale dont je viens de parler.

"Déjà beaucoup d'entre nous ont été pressentis relativement à l'opportunité d'un tel travail, et c'est sur l'avis favorable de notre Compagnie que la Société Royale a résolu de faire adresser diplomatiquement à tous les Gouvernements la demande de désigner des délégués pour une Conférence internationale, destinée à rechercher les meilleurs moyens de réaliser cette publication. Jusqu'ici, les réunions du Comité du Catalogue de la Société Royale n'ont été que préparatoires ; il semble toutefois que, sur certains points, l'accord doive être unanime. Il faut, par exemple, que le titre de chaque travail en indique aussi explicitement que possible la nature et les conclusions ; il faut que les titres de certaines Notes se répètent en différents points du répertoire, lorsqu'elles se rattachent naturellement à plusieurs sections du Catalogue. Sur tous ces points, et sur bien d'autres encore, la Commission internationale devra statuer.

"L'importance de l'entreprise ne paraît pas discutable, le nombre toujours croissant des publications scientifiques rend aujourd'hui presque impossible la connaissance des travaux effectués sur un sujet donné ; les revendications de priorité occupent, dans les Ouvrages scientifiques, une place excessive, et beaucoup de savants dépensent en pure perte des mois et des années pour avoir ignoré des travaux antérieurs sur l'objet de leurs études.

"La question est du reste à l'ordre du jour ; plusieurs Sociétés savantes ont déjà des Catalogues très complets, d'autres sont moins bien partagées, mais peuvent déjà fournir de précieux éléments pour le travail d'ensemble. L'Amérique, la Belgique, la France et plusieurs autres nations ont dernièrement réalisé de grands progrès dans la manière de cataloguer les publications scientifiques. On peut donc espérer que, si l'action diplomatique est assez prompte, les délégués des différentes nations pourront se mettre à l'œuvre dès l'année prochaine et feront concentrer pour un travail commun toutes les forces éparses aujourd'hui.

"Dans l'esprit de la Société Royale, les dernières années de ce siècle seraient consacrées à introduire, dans le classement des documents scientifiques, tous les perfectionnements que l'expérience montrera nécessaires, afin que, dès l'an 1901, l'œuvre puisse se poursuivre régulièrement dans sa forme définitive.

"Tels sont les points qui ont été discutés dans la séance du Comité à laquelle j'ai eu l'honneur d'assister et que je me suis chargé de vous transmettre officieusement, en attendant que notre Compagnie en soit saisie d'une manière officielle."

THE HABITS OF THE CUCKOO.

IN an interesting and very valuable series of papers, published in the *Journal für Ornithologie*, and the *Ornith. Monatschrift*, Dr. E. Reh records his latest observations on the parasitic habits of the common cuckoo, which seem to entirely confirm what he has already given us in his larger work, "Altes und Neues aus dem Haushalte des Kuckucks."

In 1893, not more than two kilometres from Leipzig, no less than 70 nests were found containing cuckoo eggs ; of which, 58 (83 per cent.) were in nests of the Red-backed Shrike (*Lanius collurio*).

In this year it was observed that five females were missing, while at the same time eight females were detected as new to the locality. Four new foster-parents were also noted. An approximate balance is thus preserved. Fresh arrivals are recognised by means of their eggs ; for Dr. Reh finds that the colouration of the egg of every female is peculiar to itself, and constant. Each cuckoo returns every year to the same locality, and lays its eggs only in the nests of that particular species which it, or its ancestors, happen to have adopted for that purpose. Thus, not only can every egg in a district be identified, but the number laid by any given female can be determined with a tolerable degree of accuracy.

This yearly census of the cuckoo population seems to show that the young do not return to their birthplace to breed ; or that, if they return, they do not succeed in laying eggs, being driven away by the parent birds. The evidence for this view is based partly on the fact that the numbers remain approximately fixed for each locality, and partly on the assumption that the egg of the daughter cuckoo would be similar to, but not exactly like that of the parent. It has been found, however, that the eggs which are presumably new to a locality are of types totally distinct from the types of eggs laid by birds which, so to speak, belong to the neighbourhood.

Cuckoos would seem to be more prolific than is generally supposed, an egg being deposited on alternate days from the middle of May to the middle of July. Occasionally it happens that an egg is laid every day for a short period, but such an occurrence is rare. Sometimes two eggs are found in the same nest. Such cases can always be referred to particular birds which seem to have a tendency to colonise, as is the case with an American ally, *Crotophaga*.

It is related that on one occasion a male cuckoo was seen leaving a shrike's nest, noisily calling the while, and pursued by one of the infuriated owners—whether male or female could not be determined—until at length both were lost to view. The whole proceeding produced the impression that the male had purposely provoked the chase in order to give the female time to deposit its egg. When the shrike returned it was accompanied by its mate. On the previous day this nest had been found empty ; at 3 p.m. on the afternoon on which the chase occurred it contained one shrike's egg ; on a third inspection it was observed that a cuckoo's egg had been added.

As an additional piece of evidence in support of the contention that the cuckoo first deposits its egg on the ground and thence carries it to the selected nest, Dr. Reh quotes a case in which a cuckoo's egg was found smeared with red earth similar to that which occurred in the immediate vicinity of the nest from which this egg was taken.

As is well known, cuckoos' eggs found in the nests of some species of host differ widely one from another in colouration, while those from the nests of certain other species show a great similarity amongst themselves. Dr. Reh points out further that precisely the same features obtain among the species with which these eggs are found. Thus cuckoos' eggs from nests of the red-backed shrike show a wide dissimilarity in colouration, but not more so than do those of the shrikes themselves ; but, on the other hand, cuckoos' eggs from the nests of the wren exhibit great uniformity of colouration, just as do those of the host. As an explanation of these facts, it is suggested that this variability is due to the nature of the food upon

which the young birds are reared; in the case of the shrike the diet is of a mixed nature, but is fairly uniform in the case of the wren. To secure a foundation for this theory it is assumed that cuckoos, when about to deposit their eggs, intuitively select the nests of the species by which they themselves were reared. Thus it has come about that each particular species of host rears the young of a particular race of cuckoo, the eggs of which, like those of the host, exhibit great variability when the food during the nesting period is mixed, and great uniformity when the food is uniform.

These papers are based upon a great number of observations, which are exhaustively analysed and tabulated for the benefit of those who may be fond of statistics.

THE YORKSHIRE GYPSEY-SPRINGS.

TEN miles to westward of Bridlington Quay, in Yorkshire, is the much-neglected village of Wold Newton, situated, as the name indicates, among the Wolds. It is noted as being the place where the great Yorkshire aerolite—exhibited in the British Museum—fell on December 13, 1795, but more chiefly as being the birthplace of several phenomenal springs known as gypsies (the initial letter "g" pronounced hard). The gypsies of Yorkshire resemble the nailbournes of Kent.

They are variable and intermittent springs of very clear and cold water, and appear on the surface of the chalk valleys. So freely do the calcareous wolds absorb rain, that they will allow it to pass underground as far as the blue gault on which the chalk rests. Consequently, there is scarcely a permanent surface-stream in any of the numerous hollows that lacerate the chalk-hills. The gypsies simply make their appearance in winter, or early spring, or at other periods after heavy rains, when the chalk is saturated. They will sometimes flow for two or three months, then suddenly cease, leaving scarcely a mark upon their birthplaces. They have been known to have been quite inactive for three consecutive years. The emission is often so copious as to constitute a very considerable stream, filling a drain twelve feet wide and three feet deep. This is called the gypsey-race, and it conveys the flushed tide through the villages of Burton Fleming, Rudstone, Boynton, and finally disembogues it through Bridlington harbour into the sea.

The principal gypsey-head is in a field on the left side of the road between Wold Newton and Foxholes. Another gypsey rises to the light at Kilham, seven miles away. It happened fortunate that a native of Wold Newton and I caught the springs all open last Eastertide. We trod over a deal of spongy grass-land to pursue inquiries at the gypsey-head, and were rewarded by finding water issuing through the grass where the ground was not broken, and elsewhere rushing with considerable force over the surface to the height of our boot-tops. Every one of these little eruptions contributes to the race, and by it gets eventually to the sea.

At the western extremity of the great west to east valley of the Wolds—through which ran the old Bridlington and Malton high-road—there is a spring in a bank about a furlong or two east of Wharram-le-Street. This is the fountain-head of the Wold Beck—once known locally as "Lord Carlisle's River"—which travels for some nine miles past the doors of Duggleby, Kirby Grindalythe, West and East Lutton, Helperthorpe, and Weaverthorpe (a street of valley villages). This beck gradually sinks, and finally disappears below the surface before it reaches Butterwick, its sub-surface course being lengthened or shortened as wetness or drought prevails. Some say this beck next reappears at Rudstone; but, in any case, it no doubt feeds the gypsey-head near Wold Newton when the surrounding chalk is all well saturated with rain.

The race has been known dry for three consecutive years, while once or twice it has carried two or three feet of water in mid-August. On Christmas Day, about twenty years ago, it caused the village of Burton Fleming to be flooded, and a farmer I spoke to there said he went about wet-shod for a couple of months owing to this inundation. The gypsies originally shaped a channel for themselves. An attempt to divert this at Burton Fleming proved a failure, so a broad and deep drain of the dimensions already given was cut right away to the sea, and called the gypsey-race. When in flood, it looks like a pellucid trout-stream—twelve-pound trout have been killed on its banks; but there are no fish in it now, and the bed is for miles covered with long emeraldine grass, rippling like tangles of naïads' hair along the swift current. The grass hides the chalk and every pebble; there is no babbling sound; all Yorkshire besides has no stream purer.

Only a century or two ago there were still surviving, from the days of monasteries, many silly superstitions and traditions then attached to the mysterious conduct of the gypsies. In an old tour, said to be written by Defoe, we read that "whensoever those gypsies—or, as some call them, vipsies—break out, there will certainly ensue famine or plague." In fact, as the overflowing of the Nile was to the ancients long an enigma, so was the rising of the gypsies, and may be yet so, even to some of the learned. HARWOOD BRIERLEY.

NOTES.

PROF. SYLVESTER has been elected an Associate of the Brussels Academy of Sciences.

SIR WILLIAM H. FLOWER has been elected a Foreign Member of the Royal Swedish Academy of Sciences, in the place of the late Prof. Huxley.

PROF. RAY LANKESTER has been elected a Corresponding Member of the St. Petersburg Academy of Sciences.

PROF. G. F. FITZGERALD, F.R.S., will deliver the Helmholtz Memorial Lecture at an extra meeting of the Chemical Society, to be held on January 23, 1896.

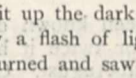
THE Valz prize of the Paris Academy of Sciences has been awarded to Mr. W. F. Denning for his observations of shooting stars, discoveries of comets, and other astronomical work.

THE Albert Lévy prize, of the value of £2000 sterling, has, says the *British Medical Journal*, been awarded by the Academy of Medicine to Drs. Behring, of Berlin, and Roux, Sub-Director of the Pasteur Institute in Paris, for their discovery of the means of curing diphtheria.

ONE of the special features of the exhibition to be held at Berlin next year is to be an interesting and instructive Department of Horticulture. This portion of the exhibition is being carried out under the direction of Herr L. Spath, an acknowledged authority on horticulture.

A CORRESPONDENT writes that on December 12, at about 6.10 p.m., he was walking towards Brownhills Station near Walsall, when he heard a loud hissing sound, and, on looking round, saw a meteor falling, of a blue colour, and dropping sparks in its course. It was travelling S. 20° W. and apparently at an angle of about 20° with the horizon.

A DESCRIPTION of another meteor has come to us through the Meteorological Office. Writing from Oakford, Bampton, North Devon, Lieut. Wolfe Murray says:—"Last night [December 17], at about 6.30 p.m., I observed a very brilliant meteor. The

brilliancy was such that it lit up the dark road (a lane with a high hedge) as though by a flash of lightning, or like a bright moonlight night. I turned and saw the meteor, almost due north from me, flash through about 5° of the sky, then separate into three distinct portions, of the following relative sizes roughly 

, and then vanish."

WE learn from the *British Medical Journal* that the Government of India have approved of a Committee, to assemble in Calcutta in January next, to revise the present cholera rules for the Forces, of which Mr. Hart spoke as inadequate and discreditable. The Committee will be composed of the Quartermaster-General in India, the Principal Medical Officers H.M. Forces in India, and the Sanitary Commissioner with the Government, associated with Mr. Hankin, the bacteriologist.

It is proposed to form a society to bring together more closely those who have taken up Reptiles as their hobby, and it is hoped that by this means interest may be kept up and mutual help secured by all concerned. Dr. Arthur Stradling has consented to become President. In order that a working basis may be secured at once, those who intend to become members should communicate with the Secretary, Rand Rectory, Wragby, Lincolnshire.

ON Friday last, several members of the British Chamber of Commerce, which has for some years advocated in the interest of English trade the adoption of the metric system in England, visited the boys' and girls' elementary schools of the Tenth Arrondissement at Paris, and listened to a lesson on the system, with the idea of seeing the ease with which it is taught and the efficiency attained. On Saturday, the members were received officially by the Paris Municipal Council, the President of which referred to the prospect that the metric system would be an additional link of fellowship between the two nations.

THE Annual Progress Report of the Geological Survey of Queensland is chiefly interesting from the account it contains of Mr. Jack's investigations into the artesian water supply of that country. A paper on the subject was read to the Australian Association nearly a year ago, so that the general results are not new. It seems probable that all the water obtained by sinking into the "Blythesdale Braystone" and other porous beds of the Lower Cretaceous is only an insignificant part of the total amount which must otherwise drain off into the sea, so that the amount of water obtained is capable of indefinite increase. There is a statistical appendix on the various artesian wells; and many matters of local geology are also dealt with in the report.

THE possibility that the ores and other vein minerals have been segregated in the veins out of the minute quantities diffused through the country-rock they traverse is so suggestive a one, that great interest attaches to any discovery that may throw light on this question. In New South Wales, auriferous granite has been known and worked for several years past in the Timbarra district. The rocks of this gold-field have recently been described by Mr. G. W. Card (*Records* Geol. Survey New South Wales, vol. iv. pt. iv. p. 154), who has found gold and silver in both the granite itself, which is a binary granite, and in eurite-veins which cut it. Moreover, small auriferous quartz-veins cut the granite. The exact mode of occurrence of the gold in the igneous rocks does not seem to have been made out.

THE diamond fields of Bingara, New South Wales, have been examined and reported on by Mr. G. A. Stonier, of the Government Geological Survey, with the view of ascertaining whether or not they resemble the deposits at Kimberley, in South Africa. It has been decided that no such resemblance can be made out, but no new light has been thrown on the genesis of the diamond. At Bingara, the diamonds are found in alluvial drifts of Tertiary age, in which pebbles of jasper, much waterworn, predominate, and nothing resembling the picrite-porphyry of Kimberley is found in the neighbourhood. It has long been held that the diamonds at Bingara were formed *in situ* in the drifts, but this view is not supported by Mr. Stonier. He suggests that the source of the diamonds is an intrusive mass of serpentine (an altered peridotite), which has metamorphosed the carboniferous rocks in the vicinity, producing great quantities of jasper, and of this, as already stated, the diamantiferous gravels are chiefly formed. The diamonds themselves are of superior quality to most of those found at Kimberley; but, being somewhat harder, take longer to polish. The largest stone found hitherto was only $2\frac{5}{8}$ carats in weight when rough, and not quite $\frac{3}{4}$ carat after it had been cut.

A RECENT number of the *Comptes rendus* (December 2, 1895, contains an account of a determination of the ratio v of the electrostatic and the electromagnetic units made by M. D. Hurmuzescu. The author has employed a method, first used by Maxwell, in which an electrostatic attraction is balanced by the repulsion between two circuits carrying a current. The electrostatic difference of potential at the ends of a known resistance R traversed by a current is obtained by an absolute electrometer with a cylindrical movable electrode. The current which passes through the resistance R also passes through an electro-dynamometer, the movable coil of which is rigidly attached to the lever carrying the attracted cylinder of the electrometer. This electro-dynamometer consists of a long solenoid with a single layer of wire, and of a small movable coil placed at the centre of this solenoid, and inclined at 90° to the axis of the solenoid. The value of the resistance R, for which the turning couples due to the electrometer and dynamometer are exactly equal, is found, and from the geometrical constants of the instrument the value of v can be calculated. The author considers that the length measurements, &c., are correct to 1 in 3000, and that the accuracy of the value of v is limited by the accuracy with which the ohm is known. The results obtained give values for v being between $3{\cdot}0005 \times 10^{10}$ and $3{\cdot}0020 \times 10^{10}$.

A NEW heavy liquid has been discovered. Mr. S. L. Penfield describes its preparation in the December number of the *American Journal of Science*. Mix equal proportions of the nitrate of silver and thallium, and on heating the mixture it fuses at 75° C., forming a clear mobile liquid of density 4·5, which mixes with water in all proportions. It can therefore be used to separate mineral particles of densities below 4·5. When still heavier particles have to be separated, the proportion of thallium may be increased. When the ratio is 3 : 4 the mixture fuses below 100° C. and has a density of about 4·7. At 2 : 4 the fusing point becomes 150° C., and the density 4·8; at 1 : 4 it is about 4·9, and fusion only takes place at 200°. Finally, when pure thallium nitrate is used, the point of fusion is 250° C., and the density closely approaches 5. This high range of densities, together with the fact that the salts do not attack many minerals, make the liquid especially valuable for mineralogical purposes. A convenient separator is described by the same author. It consists of a thimble-shaped cup into which a wide tube is made to fit. The tube can be closed at the bottom by a hollow plug. This plug being removed, the heavy liquid is poured through the tube into the thimble, and the minerals are thrown in and stirred. The heavy particles sink into the thimble, and may be removed by closing the tube with the plug, and withdrawing the thimble. The latter is then replaced, and the operation repeated with dilute liquid. With some practice an elaborate separation by densities is rapidly and easily accomplished.

A POSSIBLE method of determining the directions of atmospheric currents at high altitudes, independently of the observations of cloud movements, was suggested by Señor V. Ventosa, of the Madrid Observatory, in 1890; since then he has continued the investigation with great perseverance. The basis of the method consists in the observation of the undulations round the sun's limb, which are so trying to solar observers. In their greatest simplicity, these waves are tangential to the disc at two diametrically opposite points, and cut normally in the positions at right angles, all of them trending in the same direction. Usually, however, there are several superposed systems, and the difficulty is to separate them clearly one from another. The wind near the earth's surface is not often found to affect the appearances on the sun's limb, the explanation being that the waves produced by such a current must be greatly out of focus in the telescope. In fact, by varying the position of the eye-piece and determining the displacement necessary to bring the different systems of waves most clearly into view, the corresponding altitudes of the currents producing them can be found by applying the ordinary formula for conjugate foci. A large number of observations of this nature have been accumulated by Señor Ventosa, and as a control, observations of clouds have also been made; a tabulation of results certainly seems to indicate that the new method may be useful. Generally speaking, the direction of the superior currents is unlike that of the wind near the surface of the earth. A result of some interest is that on 150 days on which two currents were indicated, the mean height of the "neutral plane" was 2430 metres. It also appears that as the altitude increases the direction of movement usually changes in the opposite direction to the hands of a watch. The method seems to be well worth further investigation.

TWO important papers have recently been published on the effect of the electric light and of electricity on vegetation. The first is by M. Bonnier in the *Revue Générale de Botanique*. He states that a continuous electric light promotes the formation of chlorophyll, and brings about, at the same time, a simpler anatomical structure of the leaves. Under a continuous electric light the distribution of the chlorophyll in the tissues is more extended than in ordinary daylight; chlorophyll-grains make their appearance in the cortex as far as the endoderm, and even in the medullary rays and the pith. The palisade-tissue of the leaf is reduced, or entirely disappears, and the epidermal cell-walls are thinner. The bark is less developed, and the various tissues of the stem are less differentiated. When the electric light is discontinuous, as, for example, when turned on twelve hours out of the twenty-four, the effect on vegetation is intermediate between that of normal sunlight and that of a continuous electric light. Alpine plants cultivated under a continuous electric light exhibit points of structure identical with those of Arctic plants, which are exposed to almost continuous sunlight in the summer. The other paper is by Prof. A. Aloi in the *Bulletino* of the Italtan Botanical Society. He adduces evidence in favour of his view that both terrestrial and atmospheric electricity exercise a favourable influence on the germination of seeds and on the growth of plants, and predicts that the employment of electricity will be a most important factor in the agriculture of the future.

WE have received a valuable memoir on the Greek earthquakes of 1894, from Dr. S. A. Papavasiliore, the director of the geodynamic section of the observatory of Athens. We have already (vol. l. p. 607) given a full account of these shocks, in summarising two preliminary papers by the same author.

THE Roman earthquake of last November 1, is the subject of a short paper read by Prof. Tacchini before the *Reale Accademia dei Lincei* ("Rendiconti," vol. iv., 1895, pp. 221–223). The area over which the shock was perceptible, without the aid of instruments, contains about 11,600 sq. km. The epicentre was probably near, or under the sea, in the neighbourhood of Ostia. Dr. Cancani estimates the depth of the seismic focus at about 15 km. Beyond the limits of the disturbed area, the shock was registered by microseismographs at Ischia, Siena and Florence. The times recorded by Prof. Tacchini, for Rome and Siena, give a velocity of almost exactly 2 km. per second.

IN the last number of the *Ornithologische Monatsberichte* (1895, p. 196) will be found an announcement that the German Zoological Society of Berlin has in contemplation a very important work, which will be entitled "Das Tierreich. Eine Zusammenstellung und Kennzeichnung der rezenten Tierformen." The somewhat ambitious aim of this publication is, if we understand rightly, to give on an uniform plan descriptions of all the known species of the animal kingdom, together with their distribution and most important synonymy. Prof. F. E. Schultze, of Berlin, has undertaken the general editorship of this work, but will be assisted by specialists in the different branches of zoology.

THE Royal Meteorological Institute of the Netherlands has made a valuable contribution to maritime meteorology by the publication of a large folio atlas of the Guinea and equatorial currents, embracing that part of the Atlantic Ocean between lat. 2° and 24° N., and from the west coast of Africa to long. 29° W., which includes the limits of the African North Polar current. The charts, of which there are several for each month, show clearly how the Guinea current divides into two branches, one setting to N.E. and the other to S.E., the various changes in the temperature of air and sea-surface, the regions of trade winds, calms, rain and other phenomena. The principal direction of the Guinea current being towards the east, while the equatorial currents set towards the west, the former is represented in black and the latter in red. The materials for the charts have been obtained entirely from logs kept on Dutch vessels.

AN interesting paper by Miss Grace E. Cooley is reprinted from the *Memoirs* of the Boston Society of Natural History, on the reserve-cellulose of the seeds of *Liliaceæ* and of some related orders. She states that reserve-cellulose appears, as such, on the walls of the cells soon after the endosperm is formed. Sugar and oil are present in the cells before the appearance of reserve-cellulose and during the process of the thickening of the wall, the sugar being formed first. The reserve-cellulose appears first at the angles of the cells, and extends thence to the walls. The cells of the endosperm near the chalaza are the first to have their walls thickened; those next the integuments are next affected, and the cells near the embryo are the last to mature. The paper is illustrated by six quarto plates.

A VALUABLE monograph on water supplies, by Mr. Allen Hazen has just been published, and should prove of great value to engineers and others in charge of water-works. Mr. Hazen was lately chemist in charge of the well-known Lawrence experiment station of the Massachusetts State Board of Health, and is, therefore, specially qualified for the task he has undertaken, and in the carrying out of which he has been so successful. No trouble has been spared to obtain the latest and most trustworthy information on water-works from all parts of the world. The change which has come over the conduct of water-works since the introduction of the modern methods of bacteriology is, of course, shown very clearly, and it is pointed out how, in our country, Dr. Percy Frankland's investigations, published in 1885, on the removal of bacteria by means of sand-filtration at the London Water-works, and in Germany those of Wolfthügel, Plagge and Proskauer at the Berlin Water-works, published in 1886 and 1887, were the means of furnishing the first insight into the hygienic significance of filtration.

We have on our table several volumes published by learned societies, but limits of space will not permit us to do more than refer to them briefly. One of these volumes is the twenty-second (new series) of the *Proceedings* of the American Association of Arts and Sciences, and contains twenty-two papers read before the Association between April 1894 and May 1895; among them being papers on the North American Centhophili, by Mr. S. H. Scudder; nitro-paraffine salts, and bivalent carbon, by J. U. Nef; wave-lengths of electricity on iron wires, by Mr. C. E. St. John; the blastodermic vesicle of *Sus scrofa domesticus*, by Mr. A. W. Weysse; ternary mixtures, by Mr. W. D. Bancroft; a revision of the atomic weight of strontium, by Mr. T. W. Richards; and on the relation of hysteresis to temperature, by Messrs. F. A. Laws and H. E. Warren. Another volume to which we can only briefly refer is the *Atti d. Accademia d. Scienze Fisiche e Matematiche* of Naples (vol. ii. second series). In this we find memoirs on Italian Hymenoptera, by Prof. A. Costa; on certain Abelian equations, by Prof. V. Thollame; comparison of Right Ascensions simultaneously determined at Capodimonte and Cordoba, by Prof. A. Nobile; earth-currents, by Prof. Palmieri; Italian fossil ichthyology, by Prof. F. Bassani; and several others. We have also received a volume of the *Journal of Conchology*, the first published under the direction of the Conchological Society; vol. xxvi. of the *Proceedings* of the Boston Society of Natural History (part iv. 1894–95); and a number of maps from the Geological Survey of Canada. One batch of these maps exhibits the principal auriferous creeks in the Cariboo mining district, British Columbia; a second bundle refers to the geology of Guysborough, Antigonish, and Pictou Counties, Nova Scotia; while a third contains a geological and topographical map of the southern part of the lake of the Woods and Rainy River, Ontario, Eastern Townships Map, Quebec, and a sheet showing the geological character of South-west Nova Scotia. Finally, we have to acknowledge the receipt of vol. v. part i. (second series) of the *Proceedings* of the California Academy of Sciences, a volume of nearly eight hundred pages filled with valuable papers on Californian natural history; and the second volume of "Beiträge zur Geophysik," edited by Prof. Dr. G. Gerland. In this volume we find a speculative paper on terrestrial magnetism, by Prof. A. Schmidt; a very long account and discussion of observations made with the horizontal pendulum at Strassburg, during 1892–94, by the late Dr. E. von Rebeur-Paschwitz; an extensive collection of observations of submarine earthquakes and eruptions, by Dr. E. Rudolph; and a critical study of the mean level of the solid crust of the earth, of the land and water areas, and of the relation between the land above sea-level and oceanic depressions, by Dr. H. Wagner.

OUR ASTRONOMICAL COLUMN.

Orbits and Origin of Comets.—The investigations of Schiaparelli led to the conclusion that comets moving in parabolic orbits must have originally had a very small velocity with respect to the sun, and that, apart from planetary perturbations, the probability of elliptic orbits is very small. The latter fact is demonstrated in a somewhat different way by M. V. Wellmann (*Bulletin Astronomique*, vol. xii. p. 515), the absolute velocities of the sun and comets being introduced. This method leads to the conclusion that the formation of hyperbolas is much more probable than that of ellipses, and that ellipses of large dimensions are much less probable than smaller ones; further, the supposed parabolic orbits which have been calculated are probably nearly all hyberbolas.

In conformity with the nebular hypothesis, M. Wellmann regards the substance of which comets are formed as the débris of nebulous matter not attached to any system in the process of condensation, but in unstable equilibrium, and having nearly the same proper movement as neighbouring centres of condensation. Eventually assuming a hyperbolic orbit round a neighbouring sun, the "cosmic cloud" passes off into space, and may become attached to our system *en route*.

M. Wellmann goes on to demonstrate that under the influence of a solar electrical repulsion, elliptic orbits will approach the parabolic form. Hence, in calculating the definitive orbits of comets, this repulsion should not be lost sight of; even neglecting planetary perturbations, a comet may not move rigorously in a conic section. In cases where calculation and observations are discordant, it is suggested that a reconciliation be attempted by supposing that the "constant of attraction" is itself variable, in consequence of the varying electrical repulsion. M. Wellmann also seems to be of opinion that this force of repulsion may be found sufficient to explain the inequalities in the movement of Mercury, which Leverrier ascribed to a possible intra-mercurial planet; the suggestion that the law of gravitation is not strictly true (Nature, vol. li. p. 183), adds to the probability of this explanation.

Comet Brooks, 1895.—Attention is drawn by Dr. Deichmüller to a striking similarity between the elements of Comet Brooks 1895 and those of the comet of 1652 (*Ast. Nach.*, 3322); this is shown by the following comparison, in which Kreutz's elements for Comet Brooks are adopted:—

Comet 1652.		Comet Brooks.	
T = 1652 Nov. 13		T = 1895 Oct. 21	
ω = 300° 10′6		ω = 298° 13′0	
Ω = 91 33·0	1895	Ω = 83 9·2	1895
i = 79 27·7		*i* = 75 22·8	
q = 0·847		*q* = 0·839	

The continued ephemeris for the comet, following Dr. Berberich, is as follows:—

	R.A.	Decl.
	h. m. s.	° ′
Dec. 27 ...	3 18 39 ...	+68 45·1
28 ...	3 9 42 ...	68 34·2
29 ...	3 1 38 ...	68 22·1
30 ...	2 54 22 ...	68 9·2
31 ..	2 47 51 ...	+67 55·6

THE MOVEMENTS OF HORIZONTAL PENDULUMS.

The movements of horizontal pendulums referred to in this note are those which have been observed in Japan and the Isle of Wight. In reports to the British Association on the earthquake and volcanic phenomena of Japan in the years 1883, 1884, 1885, 1887, 1888, 1892, 1893, and 1894, abstracts are given of work which has been carried out in that country in the investigation of earth tremors or pulsations, diurnal waves, and other earth movements. The Report for 1892 describes a pair of extremely light horizontal pendulums, the movements of which, with the aid of mirrors and lenses, were recorded on photographic plates and films, and gives some account of the analysis of the resulting records. The observations were continued during the following year, when it was observed that the direction of earthquake movement in many cases coincided with the direction in which strata had been folded to form mountain ranges bordering the Tokio plain. Another observation was that certain earthquakes had been preceded by an abnormal amount of tilting. During the last year, largely in consequence of the liberality of the Royal Society of London, I have been able to extend these observations, and records have been obtained from horizontal pendulums, each provided with photographic recording apparatns, from nineteen installations. The more important of these installations were as follows. At Tokio in my house, on a massive stone column. At a place 1000 feet distant, in an underground chamber, excavated in the alluvium on a concrete bed. At Kanagawa the observatory was in an artificial cave, driven at a depth of about 50 feet in soft tuff rock beneath its junction with overlying alluvium. At Yokohama two instruments were placed in a cave on the tuff rock, about two feet below its junction with the alluvium. At Kamakura two instruments were placed in a cave on hard tuff, which dips at an angle of 30° north-east.

These instruments were oriented so that their booms pointed north-west or north-east, or parallel and at right angles to the dip of the rocks. The localities mentioned are at distances from Tokio of twenty, twenty-three, and about thirty-three miles.

The remaining installations were on brick columns rising from a bed of concrete on the alluvium, the localities being chosen with regard to the surface configuration and the proximity or absence of a covering of forest or buildings which would influence the effects of solar radiation. Underground and in the caves, which represent seven out of the nineteen installations, the daily change in temperature was not appreciable on the diagram from a self-recording thermometer. At other stations this change was often very great.

The Instruments.

The pendulums consisted of a horizontal boom about 5 feet in length, held up by a fine brass wire. They had different degrees of sensitiveness. Usually the adjustment was such that the outer end of the boom was displaced 1 mm. by tilting the bed plate of the apparatus from 0″·1 to 0″·5. At the extremity of the boom there is a light metal plate with a slit in it parallel to the length of the boom. Underneath this floating slit, but at right angles to it, there is a narrow slit in the top of a box. Light, after passing through the two slits, goes into the box as a point which is received on a drum carrying a photographic film, which usually lasted one week.

No accuracy of adjustment is required, and if the pendulum is steady without the aid of a single lens, the photographic trace is a remarkably clear line.

If there are two slits—one broad and the other narrow—in the floating plate, two lines may be produced, one of which is thick, and the other extremely fine. For quick movements of the pendulum, the best diagram is given by the former, whilst for slow displacements the latter has the clearer definition.

A modification of these arrangements is one which I used in Japan, and which is now in operation at Shide, in the Isle of Wight. In this instrument the boom is built up of straw and reed about 2·5 feet long, and weighs less than ·25 oz. At its outer end there is a small mica plate, which is blackened, and has two slits in it parallel to the length of the boom. At a distance of 1·5 inches from its inner end, where there is a brass socket and an agate cup, a pivoted weight is so arranged that it balances the outer part of the boom. The apparatus is therefore equivalent to an extremely light conical pendulum seismograph, which multiplies tremor-like motion about sixteen times, but which is at the same time very sensitive to changes in the vertical. When the pendulum has a period of sixteen or eighteen seconds, one millimetre deflection of the end of the boom indicates a tilting of 0″·70. The record is received upon a roll of bromide paper passing beneath a fixed slit in the lid of a box, above which is the boom and mica plate. This moves at a rate of about forty-two millimetres per hour. Should this paper move at a varying speed, this is checked by an ordinary watch so placed upon the lid of the box with the fixed slit, that its long hand every hour crosses freely over a portion of this slit not covered by the floating plate, and by eclipsing the light, causes hourly time-marks to be made on the band of bromide. On many occasions I have caused the pendulum to move at *known* times, and subsequently determined the times at which these disturbances took place by measurements made on the bromide film after development. The errors usually varied between three and ten seconds.

These pendulums have worked well in damp caves and with unskilled assistants. One assistant was a shopkeeper's daughter, twelve years old, whose duty it was to refill and light a benzine lamp every twenty-four hours. The records obtained were very much freer from tremor effects than anything I have obtained when working with a pendulum, the boom of which was a two-inch piece of aluminium wire held in position by a quartz fibre, and giving its record by mirrors and lenses.

The movements recorded have been as follows.

(1) *The Wandering and Long-period Movements of Pendulums.*

All the horizontal pendulums wherever situated have slowly wandered from their normal position. Those on the rock have often gradually moved to one side and then returned, the double excursion usually taking from two days to a week. Underground on alluvium *within twelve feet of water-level* the wandering was at times so great that the spot of light left the film, which was two inches broad, and readjustments were often necessary. From the readings of the end of the pointers, it would appear that in some cases at least, had the pendulums been given sufficient time they might have returned to their starting point. The pendulum in my house, one thousand feet distant from those underground, but *thirty-six feet above water-level*, although usually more sensitive than those beneath the surface, wandered to a less degree. These wanderings might be due to a local warping of the supporting column, but inasmuch as it has generally happened that the periods of great movement and of comparative rest of different instruments have coincided in time, it would seem that the movements are in all probability due to a more general cause. Because great movements have usually been marked (but by no means always) at or after a rainfall, some of them may be attributed to fluctuations in the volume and flow of underground water, the pendulum nearest to this water moving the most.

The other movements, especially those of the pendulum, situated in my house, and those of the instruments on the rock, have been accompanied by local earthquakes, conveying the impression that they represent actual rock bending, the earthquakes being interruptions in the process. As the number of observations are limited, and as I am not in a position to determine which of the earthquakes recorded in Tokio are of local origin, and which originated at a distance, although the materials for making this determination have been accumulated at the Central Observatory in Tokio, the matter is one requiring further attention.

Two pendulums on the alluvium, four hundred yards distant from each other and very differently installed, for periods varying between four and forty days, have moved at the same time in the same directions.

These movements may therefore be due to some general cause. A rough agreement with a barometric curve suggests the idea that the cause is due to variations in atmospheric pressure, but it is equally possible that they may be due to a greater evaporation or precipitation of moisture on one side of these stations than upon the other sides.

(2) *Diurnal Waves.*

By a diurnal wave I mean a deviation of the vertical during one portion of a given period of twenty-four hours in one direction, followed by a retrograde motion during the remaining portion of this interval. On rock foundations my instruments, which never had a sensibility exceeding 1 mm. deflection for a tilt of 0″·1, have failed to show such a movement. With instruments having a greater sensibility it is likely that its presence would be detected. These movements, which may, for example, be shown by a westerly displacement of a pendulum through a distance of from 2 to 40 mm. from about 6 a.m. until about 3 p.m., and an easterly motion until the following morning, may be best studied from diagrams on films which have moved at a rate of about 3 or 4 inches per day.

In the underground chamber in the alluvium, within 12 feet of the surface, where the daily change in temperature was less than 1° C., the daily waves were often marked. On the surface at my house, on a good foundation protected by a long building, the wave was marked, but slight.

At stations protected on all sides by high trees from the sun it was feeble. At all other stations, where on one side at least there was open ground exposed to the sun, with the *exception of rainy or cloudy days, when the photographic trace was a straight line, it was very marked, the deflection sometimes amounting to 40 millimetres.* On one hill, from about 6 a.m. to 6 p.m. the motion was westwards, while at the other side of a swampy valley running N.N.W. the movements were at the same hour almost in a contrary direction. It would appear that on every fine day the trees on the hills on the two sides of this valley bow first towards and then away from each other.

For the present I am inclined to regard these phenomena as being due to a tilting of the surface in consequence of the evaporation of moisture. This effect extends to some depth.

On open ground in the morning more moisture is taken away from the eastern side of a station than from the western side, and therefore the eastern side, being relieved of a load, rises, and the pendulum swings westwards.

In the afternoon this action is reversed, and the pendulum turns eastwards.

The waves due to this effect differ in time of occurrence and in amplitude according to the character of the locality in which they are observed.

The movement at night is slight. It may be a continuation of the sun effect modified by the precipitation of dew from the atmosphere, and by the condensation of aqueous vapour rising in ground heated during the day but chilled on its surface after sunset. The sub-surface condensation sometimes represents a load one-tenth of that taken away by evaporation. Like dew

and evaporation, its amount varies daily, and with localit and on two sides of a given station it reaches a maximum at different times.

Experiments bearing upon these Suggestions.

(1) Ten men and boys, representing a load of about 1000 lbs., at a distance of 15 feet from the stone column carrying the pendulum in my house, causes it to move as if the ground had been depressed upon the side of the load.

(2) By quickly emptying a well, which is distant about 100 feet from the above column, of about two tons of water, which was run off down a hill, the pendulum moved away from the well, behaving as if the ground had been relieved of a load on that side.

(3) A self-recording tide-gauge was set up in an unused well 80 yards distant from the underground chamber. This showed that the water in the well rose and fell ¼ to ½ inch *twice* every 24 hours. The times of sinking, which occur in the morning and the evening, may correspond with the times at which the most water is being drawn from wells in the city. I have not determined whether these movements have any influence upon a small wave which is often superimposed upon the large diurnal wave.

(4) I find from experiment that on fine days the ground in my garden may lose by evaporation 4 or 5 lbs. of moisture per square yard, or from an area measuring 20 by 20 yards about 1 ton.

I also observe that during a bright fine day that, in most cases, pendulums move away from areas that are being relieved of loads in this manner, and which may therefore be rising.

(5) Because it often happens that a board which has been lying on the grass all night is found in the morning to be wet on its under side, whilst all around the grass may be dry, the following experiment was made on sub-surface condensation. Two shallow trays about 1 foot 6 inches square were filled with earth, and placed on a flat surface of earth in my garden. One of these trays had a bottom of sheet tin, whilst the other had a bottom of fine wire netting. These were weighed morning and evening, and it was found that sometimes the box with the fine wire netting had increased in weight, while the other had not changed. The inference from this is, that during a hot day the ground is sensibly heated to a depth of one foot. This was proved by diagrams from self-recording thermometers, which for periods of a week had been buried at varying depths. After sunset the surface of the ground is quickly chilled, and aqueous vapour rising into this is condensed to augment the surface weight.

An open area, which during a day may have lost more weight by evaporation than a neighbouring area which is covered, will, if both areas are connected with the same subterranean water supply, gain the most in weight, not only by an action of this sort, but also by the condensation of moisture as it escapes from the surface, and by the precipitation of moisture from the atmosphere. These actions may in part account for the retrograde motion of pendulums during the night. Although differential evaporations and condensations are apparently sufficient to account for certain observations made in Japan, other observations exist to which they are not so apparently applicable. The cause of diurnal waves is therefore not yet known with certainty.

(3) *Earth Tremors.*

The continuous photographic records taken in Japan have thrown much new light upon the occurrence of tremors, while an experiment made at Shide in the Isle of Wight, where a light horizontal pendulum has been established to record earthquakes having their origins in distant localities, has indicated a cause of movements which probably have often been attributed to movements of the ground.

We know that tremors are more frequent during the winter than during the summer, that they are frequent with a low barometer, and still more frequent when the locality of observation is crossed by a steep barometrical gradient. From these latter accompanying conditions, it may be inferred that tremors may occur whenever a strong wind is blowing, although near to the observing station the atmosphere may be perfectly calm. Recent observations in Japan have shown that tremors are more frequent during the night than they are during the day, and that maxima of motion are reached between 5 and 9 a.m. In fact, some instruments have always shown movements about these hours. One very important observation is that the greatest movements have been recorded by the lightest pendulums. For example, a pendulum having a boom from one quarter to four inches in length is a better tremor recorder than one which has a boom several feet in length.

The pendulum at Shide was set up upon a newly-built brick pier. Because moisture was given off from this, the inside of the covering case became exceedingly damp, and the bromide film became sticky. To overcome this difficulty, two trays of calcium chloride were placed inside the covering. A few minutes after this it was observed that the pendulum commenced to swing. When the calcium chloride was removed the pendulum came to rest. This experiment was repeated several times, and the conclusion arrived at was that rapid desiccation produced air currents of sufficient intensity to cause a light pendulum to move, and the diagrams of these movements are not distinguishable from those attributed to *earth* tremors. Although experiment has shown that differences in temperature of the walls enclosing a light pendulum will cause the same to swing, I have no reason to think that movements due to such causes have been recorded. All that can be said at present is that a difference in the rate at which moisture is absorbed by or evaporated from the different walls of a casing covering a light pendulum, may cause the same to swing. Before we should attempt to explain why such movements are marked at particular hours, and occur with certain meteorological conditions, the necessity of further experiments is obvious. Air currents can hardly explain a set of tremors lasting several hours, where a seventeen seconds pendulum moves back and forth with uniform amplitude and a uniform period of two or three minutes.

(4) *Earthquakes.*

At Kamakura, on the hard rock, the greatest earthquake motion has been given by the pendulum which records tilting parallel to the dip—suggesting the idea that in this direction there is an easier yielding (like the opening and shutting of a concertina) than there is in a direction parallel to the strike. The movements, even for unfelt earthquakes, are sometimes as much as 40 mm., and a disturbance may continue for several hours. On March 22, I and my colleague, Mr. C. D. West, watched an earthquake for 1 hour and 47 minutes, during which time the pendulum did not *swing*, hut was *forced* backwards and forwards intermittently, and with extreme irregularity. These earthquakes are in the form of earth waves, and usually come from a great distance. A sharp shock which may be felt throughout Tokio and at many places in the country, does not disturb the pendulums, and it is difficult to find a blurr on the photographic trace.

As in previous years, before certain local earthquakes I have observed abnormal tilting, an explanation for which is suggested in the section on the wandering of pendulums. It is seldom that abnormal tilting has taken place without local disturbances. Local disturbances, unless they are large, which fortunately is of rare occurrence, are only recorded by seismographs.

One disturbance which I recorded at three stations in Japan was one which had its origin near to the antipodes of that country in the Argentine Republic. The conclusion to be derived from this and other observations is that a large earthquake may be recorded at any point upon the surface of the earth. The preliminary tremors seem to reach distant places with a velocity twice or three times that with which mechanical vibrations can be transmitted through glass or steel. Possibly they come *through* our earth, which therefore may have a higher effective rigidity than hitherto supposed. The undulatory motions which follow the tremors may be transmitted as surface quasi-elastic gravitational waves. Their velocity of propagation lies within the limits of expectation. The chief object of the instrument established in the Isle of Wight is to determine whether it is sufficient to record the unfelt movements due to earthquakes originating in distant localities.

The first certain records of earthquakes having their origin at great distances were obtained by Dr. E. von Rebeur-Paschwitz, whose recent death has deprived the world of one of the most active workers in the new field which has been opened to seismologists.

JOHN MILNE.

THE ANTWERP METEOROLOGICAL CONGRESS.

TAKING advantage of the attendance of numerous visitors, scientific and otherwise, that the Antwerp Exhibition was likely to attract, it was proposed to hold, under the auspices of the Geographical Society of that city, a congress on meteor-

ology, aerial navigation, and allied subjects, with the particular object—as we gather from the circular convening the congress—of promoting the methodical and general observation of aerial currents. Authorities propose, but contributors decide, the result and character of the meeting, and the *compte rendu* of the congress, which has just reached us, shows that while a variety of interesting topics was brought under the notice of the members present, and discussed with greater or less detail, the ultimate aim of the promoters does not seem to have been materially advanced. Of course, the awakening of public opinion and the diffusion of information are always desirable, and the Committee responsible for the congress are to be congratulated upon the general success which has attended their efforts, though it may not be precisely in the direction they proposed to themselves.

One circumstance certainly told against the development of any complete plan, demanding the co-operation of many nationalities. The date of the congress (August 16–18) was unfortunately chosen. It clashed with the meeting of professional meteorologists, who were in session at Upsala, and thus prevented the attendance of those who could have given authority to any well-considered scheme, whose guidance would have been welcome, and whose reputation would have added weight. The President (Lieut.-General Wauwermans) had to announce, therefore, many letters of apology for non-attendance from men of science who had hoped to be present. His address was in the main historical, dealing with the progress of aeronautics and ballooning from the time of Montgolfier to the present, and a consideration of the benefits that would accrue to many mechanical applications from the more perfect knowledge of atmospheric motion and aerial currents. This address was delivered to the whole congress, which afterwards divided into two Sections—one, under the presidency of M. Lancaster, to discuss the subject of aerial currents; the other, directed by M. Van den Borren, more immediately concerning itself with aerodynamics.

To the first Section, M. Lagrange contributed a paper on the sympathetic movements of freely-suspended needles, whether magnetised or not. These practical experiments are the outcome or completion of a mathematical inquiry, published by the author in 1892, entitled, "Étude sur le Système des Forces du Monde physique." The experimental inquiry has been spread over more than two years; while two sets of apparatus—one in the cellar of the observatory, the other on a level with the ground—have been under observation. The direction in which the needles point is not constant; but both sets show a tendency to travel in azimuth from north-west to south-east from April to June, and then to retrograde towards the original position. The reason for this oscillation is discussed at great length; the author attributes it to the mechanical conditions under which a permeating fluid similar to ether would be placed when affected by all the forces, gravitational and electrical, that are continually operative. The practical result is, that further observations, conducted at a depth 30 metres below the surface, are to be prosecuted at the Royal Observatory, Brussels, and a member of the congress will carry out similar observations at the Meteorological Institute of Roumania. Canon Spée discussed the well-worn question of a possible connection between the area of spotted surface on the sun and the temperature of the earth, and, like others before him, is driven to the conclusion that any connection is not apparent. The meeting closed with a new theory of tides, both oceanic and atmospheric, but the "new" theory was not well received, and is not described in the *Compte rendu*.

At he second meeting of the Section, some papers of minor importance were read and discussed. One member read a note on the treatment of diseases of the ear by compressed air, and invoked the aid of meteorologists in a matter of aero-therapeutics. Another had something to say on the forces that affect the rotation of the earth, but this was summarily dismissed as a theory "qui aboutit à la fois à des déductions d'ordre scientifique et d'ordre philosophique." Another had arranged a system of magnetic needles with a view to the solution of the problem of weather prediction. The subjects, it will be seen, were sufficiently varied; we can only refer to two. One, by M. Lancaster, on the preparation of synoptic charts, in which he insisted on the regular publication of maps showing atmospheric currents. He indicated the progress that had been made in investigations of that character, and suggested the formation of an international bureau for the consideration of the subject. A vote of the congress supporting his views was forwarded to the Meteorological Congress sitting at Upsala.

M. Plumandon, meteorologist to the Observatory of the Puy de Dome, read a paper on the causes of storms and atmospheric disturbances. He had availed himself of the difference of altitude of the Puy de Dome (1467 m.) and of Clermont Ferrand (388 m.) to compare the variations of barometric pressure at the two levels. In summer the pressure is raised less above or falls more below the mean value at Clermont than at the summit of the Puy de Dome. The opposite rule obtains in the winter. M. Plumandon deduces from his discussion that the production of storms coincides with the greatest separation of the two barometric curves, and that storms cease when the separation is sufficiently small. Put otherwise, this means that storms occur when the ascending currents reach a sufficient intensity, and, further, that absolute values of the pressure are of less importance in producing storms than the magnitude of the separation of the barometric curves at a high and low level. M. Plumandon has also interesting remarks on the relative velocities of wind at high and low stations in the same district, derived from observations at Pic du Midi and Toulouse, at Tour Eiffel and Parc Saint Maur, Paris, and other places, from which it appears that the higher station does not always suffer most from violent winds, but that there are regions at considerable altitude where the air is on the whole less agitated than at the surface of the ground.

In the Section devoted to aerodynamics, M. Van den Borren gave an able address on the subject of aerial navigation as it stands to-day, enriched by the experiments of many able mechanicians. M. Borren, as chief of the military aerostatic service of Belgium, and having charge of the School of Aerostation at Antwerp, was able to give an interesting account of what had been there accomplished under his own eye. Experiments have been carried on to determine the resistance offered by the air to planes at different inclinations, and to surfaces of various figure, as well as to the preparation of machinery arranged for different rates of locomotion and constructed of various materials with the view of determining the friction of the air on different substances. That is to say, the problem has been studied with all the attention that experience has suggested, and the conclusion to which this expert arrives is, that the problem of aerial locomotion no longer presents any serious difficulties, that the theory is satisfactorily established, and that one may venture to proceed to execution. Neither does size offer any insuperable objection to this optimistic view. He calmly contemplates the manufacture of an aerostat 300 metres long by 30 broad, dimensions which approach, if they do not exceed, those of an Atlantic liner. An historical sketch of the progress of meteorology closed the sitting.

At the second meeting, M. Lancaster gave an account of the observations on the velocity of the wind in Belgium. In the main the author agrees with the results to which M. Hann, of Vienna, had been previously led. The paper, which is of great interest, appears in full in an annexe, forming the second part of the *Compte rendu*, being the memoirs presented to the congress. Another paper, to which we give only a brief reference here, is from M. Ventosa, astronomer at the Observatory of Madrid. It has for its object the determination of the direction of wind at high levels from observation of star images, and also that of the sun. This subject came before the meteorological committee at Upsala, and seems to have been well received, since M. Ventosa was encouraged to continue his observations (see NATURE, vol. li. p. 185; also p. 179 of this number).

THE HUXLEY MEMORIAL.

THE following is the official report of the first meeting of the General Committee, formed for the purpose of establishing a memorial to the late Right Hon. T. H. Huxley, P.C., held in the Museum of Practical Geology, Jermyn Street, on Wednesday, November 27, 1895. Present—250 Home Members of the General Committee. His Grace the Duke of Devonshire, K.G., in the chair.

The Duke of Devonshire, in opening the proceedings, said:—

My Lords and Gentlemen,—It would be in the highest degree presumptuous on my part if I were to attempt, in the presence of so many distinguished men of science as I see around me, to offer anything in the nature of an estimate of the character and work of Prof. Huxley, or of the services which he has rendered

to science, either as an original investigator or as an exponent. As, however, I presume that it is as the official head of the Science and Art Department that I have been asked to accept the chairmanship of this Committee, it may be proper that I should open the proceedings by a very brief statement of the official connection of Prof. Huxley with that Department, although I am perfectly aware that the services which he rendered to that Department, valued and valuable as they were, form but a very small part of the work which Prof. Huxley did for science; which, both during his lifetime and since his death, has been so fully recognised by every scientific man in the country.

Prof. Huxley, immediately after leaving the Navy, in which he commenced his career, succeeded in 1854 Prof. Forbes, as Lecturer on Natural History in the Central School of Science in Jermyn-street. This school subsequently became the Royal School of Mines. It was transferred to South Kensington in 1881, and there merged in the Royal College of Science. Prof. Huxley was the first Dean of the College, and on his retirement from the public service in 1885, he was requested by the heads of the Department to retain the office in an honorary capacity. This he did, to the day of his death; attending the meetings of the Council, and giving assistance in other ways. He was also Honorary Professor of Biology in the College, retaining a general charge of the biological section. While Professor at the College he developed his system of biological teaching—which has had so marked an influence on biological teaching in all parts of the world. On his retirement in 1885 he presented to the College the large and valuable collection of books on natural history which he had formed. The room which he occupied was, by the authority of the Lords of the Committee of Council on Education, devoted to a Huxley Biological Laboratory for research, and it is in constant use by advanced students of biology. A scholarship has been endowed in connection with the College, and the history of that endowment may be of some interest. Prof. Huxley on one occasion met in society Miss Marshall, the daughter of Mr. Matthew Marshall, for many years Chief Cashier of the Bank of England, and in consequence of a conversation which she had with Prof. Huxley on that occasion, she left to the Department a large number of books and instruments and, in addition, a bequest of £1000, from the proceeds of which the scholarship referred to has been endowed.

Prof. Huxley was, for more than forty years, intimately connected with the Science and Art Department. The Jermyn Street Museum, in which we are met to-day, is a section of that Department, and both in this lecture-theatre and in the class-rooms upstairs, Prof. Huxley for many years delivered his lectures.

It was almost my first duty—and I need not say, my painful duty—after I became President of the Council, to address (on the part of the Committee of Council on Education) a letter of condolence to Mrs. Huxley, in which the Committee placed on record its high appreciation of the servîces to science and art rendered by Prof. Huxley in the capacities to which I have referred, and in addition, on many inquiries by Royal Commissions, in which he had taken part. I am quite aware that the time of those who are here is valuable, and I shall, therefore, not detain you any longer, but must leave to others the duty of expressing the recognition of the whole of the scientific world of the brilliant life and labours of Prof. Huxley. I have thought, however, that this brief reference to the official side of Prof. Huxley's career might not form an inappropriate introduction to the wider view of his work and of his character, which it will be the duty of those who are to follow me to present to you.

Prof. M. Foster (Joint Honorary Secretary of the Provisional Committee), after referring to a number of letters expressing regret at being unable to be present at the meeting, gave a brief history of the movement for establishing a memorial, as follows:—

Very shortly after the death of Prof. Huxley, a few of his personal friends met together in the rooms of the Royal Society; they thought they would be carrying out the wishes of all by promoting such a memorial, and invited a number of representative and influential persons to meet to consider the matter. They met, and it was then thought desirable to take further steps; they therefore constituted themselves a Provisional Committee, and sent out invitations to a very much larger number of persons to form a General Committee. These invitations were very cordially received, and, among others, we had the pleasure of hearing from H.R.H. the Prince of Wales that he would join the Committee, and would, further, accept the duty of Honorary President. At that time the summer was too far advanced to take any active steps, and the meeting of the General Committee was postponed until the present date. In the meantime we approached his Grace the Duke of Devonshire, asking if it would be his wish to act as Chairman of the Committee, and his Grace kindly accepted this duty. The Provisional Committee have given much time to the consideration of various suggestions made as to the form which the proposed memorial should take; and certain resolutions, embodying the decisions arrived at, will be submitted to you; and it is for you to decide how far they shall be carried into effect.

Lord Kelvin, P.R.S., then proposed the first resolution:—

"That it is desirable to establish a memorial to the late Right Hon. Thomas Henry Huxley."

He said:—As an original investigator in biology, Huxley has, by his life-long perseverance in working for the increase of natural knowledge, left to the world a monument more enduring than any bronze or marble in which his survivors may give material expression to their gratitude. Of his originality he gave early proof. Whilst still a student in Charing Cross Hospital, he made an exceedingly skilful and acute microscopic investigation of the structure of hair; he discovered a special structure, and described it in a communication to the *Medical Times and Gazette* with so much effect that, to this day, it is known as "Huxley's layer." That was something for a young medical student to have done. His indomitable resolution to go on with work; his attraction to original investigation—an irresistible passion of his through life—was manifested from beginning to end. Soon after his technical school education in medicine was completed, he went away as medical officer to the *Rattlesnake*, on a four years' cruise. Happily, his medical duties left him some leisure; that leisure he employed in a series of most important investigations in natural history, which has made the cruise of the *Rattlesnake* celebrated in the annals of science. I cannot tell you how many memoirs he sent home from the *Rattlesnake;* some of them never came back; one he found on his return, in the shape of a memoir communicated to the Royal Society and published in its *Transactions;* it is known to all naturalists, and is admitted to be a very valuable and important paper. Several other papers were sent, including one very important paper—although it only occupies half a page of the Report of the British Association—dealing with the blood corpuscles of certain marine animals picked up in the surveying work of the *Rattlesnake*. These first works done, not in a scholastic manner as a thesis for a Degree of Philosophy, but simply from the innate fire and determined purpose of the worker, were but the beginning of a long series of memoirs which soon made the name of Huxley famous throughout the scientific world. He was very early recognised to be one of the first biological investigators of the day, and the value of his work will be declared to you by others who know thoroughly the merits of the work and the wants which that work supplied in natural science. They will tell you that his work in Comparative Anatomy was of very great value indeed; that he almost created a new era in biological science, by the great advances that he gave to the new Morphology. He carried out and extended, in the most admirable and valuable manner, the work of Von Baer and Johannes Müller, tending in this direction, and now we have—what medical students and students of natural science in Huxley's student-days could learn nothing of in school or university—we have Morphology and General Biology taught regularly and systematically; and, I believe, I may safely say, not only to the great benefit of medical science, but to the great benefit of science in general; to the great benefit of those who are studying science for the sake of knowledge and of opening their minds, and of understanding the grandeur and beauty of nature and what lay underneath it.

Huxley's work was not confined to miscroscopic examination and the dissection of plants and animals—comparative anatomy generally, including the vegetable world—although it began with that. He entered on the subject of geology and of palæontology in a manner which has left fruit of a most enduring character, especially in palæontology: his tracing of relationships, and his philosophical reasoning regarding these relationships, which led him to find in the rocks the ancestors of many creatures now living on this earth, and his contributions to the great and newly-developed science of evolution, are so well known that I need only name them to at once remind you

who have entered on that subject how much science owes to Huxley. But Huxley was not a man who was only a specialist, simply content to investigate his special subject in the complete and thorough manner which characterised all his work. From the very beginning he had a mind that must extend into philosophic thought. His moral lessons from his biological work extended even into the field of politics, and his contributions to thought in respect of theology, in themselves are such as to put Huxley's name and fame in a very high position indeed, as a man thoroughly determined to give all the benefit he could to mankind. As a worker who gives his life, who sacrifices his health, who sacrifices his time, who gives up everything for the advancement of science; but, as he tells us himself, with an object which he felt to be even greater than the advancement of science, the promotion of the welfare, moral and material, of mankind: who deserves a memorial or a monument better than Huxley?

The Right Hon. A. J. Balfour, M.P., in seconding the resolution, said:—

I gladly welcome the opportunity which the managers of this meeting have given me of lending such support as I can to the proposals that have been laid before you, for Prof. Huxley was a man who had many titles to our gratitude. I need not dwell upon what your Chairman has said with regard to Prof. Huxley's services as a teacher, or to the services he constantly gave to the Government of the day in lending his great talents to any investigations that were required of him. But putting all these relatively subordinate matters out of mind, Prof. Huxley, as a man of letters, and as a man of science, surely deserves from his fellow countrymen some permanent memorial. Every one whom I am addressing is probably well acquainted with those works which, quite apart from the matter which they contained, have earned for their author the reputation of being a master of clear, lucid, and vigorous exposition, not easily to be matched in the whole gallery of our literature. Lord Kelvin, in the observations which he has just made to you, and others far more qualified than I am to speak on such subjects, who will address you before the meeting closes, will give some indications of the great extent of the scientific labours and discoveries which will always be associated with Prof. Huxley's name. For my own part, however, if I were to try to choose among the many titles to our gratitude which he possesses, I am not sure that I should seek for it either in his literary performances, distinguished though they were, or in the series of scientific discoveries which have given him so distinguished a place among English biologists. It appears to me that Prof. Huxley has another claim, at least as great upon the gratitude of those who were born in the generation subsequent to that of Darwin. I take it that the great scientific fact of the latter half of the nineteenth century is the establishment of the doctrine of Evolution upon a scientific basis. I do not pretend to say for a moment, that in his labours in that direction, Prof. Huxley could be put upon a level with the great scientific originator of the doctrine of the Origin of Species, or with a very different and very eminent man—Mr. Herbert Spencer, who occupies so remarkable a position upon the borderland between science and philosophy. But this, I think, may truly be said, that in the critical period of scientific history which followed the publication of the "Origin of Species" in 1857, the man who did, perhaps, more than any other to stimulate public interest in the subject, to bring into line all the younger scientific thinkers of the day, to inspire them with his ardour, and with his convictions, was, probably, Prof. Huxley. That is no small title to fame. If it be the fact, that it is now the common privilege of all educated men to look at this material world in which we live, from the evolutionary standpoint, we owe it not merely to the great original investigators who started the theory, but to those who, like Prof. Huxley, did so much by their scientific discoveries to support it, or even more by their scientific preaching and their example, to spread it among all classes of their fellow countrymen. There were other questions never far absent from the mind of Prof. Huxley, as any one who knows his work will admit, as to which he has left few positive results, and concerning which differences of opinion exist; but there is, or there ought to be, no difference of opinion as to that great claim on our consideration which I have mentioned, and this, even if it stood alone, dissociated from his literary and strictly scientific work, it would, in my judgment, be quite sufficient ground for our using every exertion to carry into effect the resolution which it is my honour now to second.

Lord Playfair, in supporting the resolution, said:—

It is scarcely necessary to say one word in regard to the eminence and the scientific position of Prof. Huxley, but it has been my privilege to be associated with him in many of his undertakings and labours as a public man. I was a Professor with him in this Institution, and had the pleasure of having him as a colleague in many public inquiries and on various Royal Commissions for the benefit of the public. In higher education, the Scotch University Commission benefited by his wise counsel and breadth of culture. The present position of technical education also owes much to the advocacy and the scientific lectures which Prof. Huxley gave through the country. There is one labour in which to the time of his last illness, I had great pleasure in being associated with him—that was in the establishment of scientific scholarships of £150 a year in almost every college and university, not only in the United Kingdom, but in the Empire of India and throughout all our Colonies. That was a subject very dear to Prof. Huxley's heart, and although he was not much engaged in the executive part of it—which fell to my share as a Commissioner for the Exhibition of 1851—Huxley was a much-valued adviser in all matters relating to the establishment of these scholarships. They are all Research Scholarships, and are now exercising a benign and important influence over the science education of our great Empire. One whole autumn I had the pleasure of being in a gunboat with Prof. Huxley—being both on the Royal Commission for the examination into the fisheries of the British Coasts—and it is scarcely necessary to say he was a most active and valuable member of that Commission, both from his scientific knowledge and in estimating the value of the evidence of the fishermen in various parts of the fishery coasts of England. I do not, in speaking of his labours as a public man, wish to overrate them in comparison with his scientific work. On the contrary, I think discoveries in abstract science are of far greater importance to humanity than any labours performed for the particular generation in which the man lives. Still his public work had a great effect in making the name of Huxley popular and beloved by the people of this country; and we are entitled to ask the people for whom he has done so much in his generation—for he has left England better than he found it—to join us in making a memorial worthy of this great man whose memory is a possession dear to the country.

The resolution was then put to the meeting and carried unanimously.

Sir Joseph Hooker (Chairman of the Provisional Committee) moved the second resolution:—

"That the memorial do take the form of a statue, to be placed in the Museum of Natural History, and a medal in connection with the Royal College of Science, and that the surplus be devoted to the furtherance of biological science in some manner to be hereafter determined by the Committee, dependent upon the amount collected."

He said: As Chairman of the Provisional Committee, appointed to consider the question of a fitting testimonial to the great services to science and education of Mr. Huxley, I have the honour of saying a few words in regard to the result of its deliberations. Before doing this, you must allow me to express the singular honour I felt in being appointed to that position of Chairman, not only because of the great and important duty, but especially because of my great, long, and enduring affection and regard for Prof. Huxley. We both entered the public service as assistant surgeons and volunteer naturalists in the Royal Navy. Before Prof. Huxley went out in the *Rattlesnake*, the choice lay between us for the appointment to that vessel, and, fortunately, the choice fell upon him. Immediately upon his return a strong friendship sprang up between us, which has lasted forty-five years, throughout which he has been one of my staunchest and firmest friends. This friendship has affected me through life, and I owe a great deal of my success in scientific life to the advice, the stimulus, and the example which Prof. Huxley set me during a long career. After what has already been said by previous speakers, it would be a work of supererogation for me to go into any detail as to the great value of the services of Mr. Huxley, whether to science or education. You will be pleased to hear that these are appreciated, even more abroad than in this country: although if pleased in one sense, I

am afraid you will not feel satisfied in another. In a notice put into my hands by the Secretary, I find the Committee includes over 700 names ; a special feature of it is the high percentage of acceptances from foreigners, which exceeds that from home sources, but I hope this state of things will be speedily remedied. Many of the foreign acceptances have been accompanied by letters expressing the highest admiration for Mr. Huxley, and good wishes for the success of the memorial.

With regard to the duties of the Provisional Committee, I need not say there were a great many proposals laid before them. It is unnecessary to go through these proposals, but they received the greatest attention. They may be grouped under four heads :

(1) A statue to occupy a public position.

(2) The founding of Exhibitions, Scholarships, and Medals for Biological Research, &c.

(3) The founding of Lectureships, &c.

(4) The republication of Prof. Huxley's Scientific Publications, in a collective form.

This last proposal has, I am glad to say, been partly met by a most liberal offer made by Messrs. Macmillan, who are prepared to publish, at their own risk, in a collective memorial form, the scientific papers of the late Mr. Huxley, now scattered over the publications of various learned societies and periodicals, provided that the size does not exceed two or three volumes of royal 8vo.; all we have to do being to appoint some one to supervise this invaluable series of papers. With regard to the memorial, the Committee decided to recommend that it should take the form of a statue and a medal, as now set forth in the resolution proposed.

Mr. Leslie Stephen, in seconding the resolution, said :—

I must preface the few words which I have to address to you, by saying that I had to overcome a certain degree of reluctance in addressing myself to you to-day—I did, however, overcome that feeling—because I feel that I am under the stress of a strong sense of personal gratitude to Prof. Huxley. I knew him for, I think, nearer forty than thirty years, and during our intercourse it happened, more than once, that he was able to show kindness to me on occasions in which kindness is doubly valuable, and on which one acquires a considerable degree of power of discriminating between merely conventional courtesy, and the outpourings of a warm, cordial heart. One of these occasions happened only recently; and I have so keen a recollection of Huxley's kindness and cordial sympathy, that I could not refuse to come here to say a few words to-day. I know that I am only saying what is felt by all who knew him, that he was a man who was not only to be honoured for his intellectual power, but to be loved for his masculine and affectionate nature. But qualities of that kind are happily not so rare as to demand any public testimonial. Only when they are combined with others, it is not merely a duty, but a privilege to seize any occasion of paying what honour we can to their possessor. I will not, however, dwell upon them ; and, still less, upon those claims of Huxley as an advancer of science, of which there are other incomparably superior witnesses present. There is one point on which I, perhaps, may say a word or two without presumption. I have had the misfortune to be compelled to devote the greatest part of my energies to books, and only to see facts through the distorting medium of literature. It fell to my lot lately to read through the collected works of Prof. Huxley, and when I came to the end I felt a conviction—which Mr. Balfour has already expressed—that when the history of his time comes to be written, Prof. Huxley will find a place not only among the leaders in the most characteristic movement of the time, but also as one of the very first writers of English. There are certain reasons, perhaps, why his claims in that capacity may not be acknowledged so quickly as they ought to be by the ordinary critic. Nobody, of course, can read his lectures without admiring the force and vigour of the great intellectual gladiator. One feels of his style what I remember Hosea Biglow says, in a different connection, that—"for putting in a downright lick betwixt the eyes of humbug, none could match it." But then the critic of the present day is apt to take account only of what he calls "form," and not to attend and to dwell upon the more evanescent and indirect, intangible facts of literature ; he is apt to think that the facts state themselves, that the thing is so clear it does not want any particular skill to work it out. The argument, when it is set going, seems to evolve of its own accord, and then he criticises in the style of the famous gentleman, who said, of some great work, "I could have written it myself, if I had only had a mind to." The obvious retort was—"it was just *mind* that was wanted." And what a style like Prof. Huxley's—which calls no attention to itself, but just sets the argument plainly before it—what that shows is certainly the possession, in the first place, of a clear, logical understanding, which always goes to the heart of matter; but it shows also, I think, some other great qualities. One cannot help observing the love of fair-play, which prevents him from ever striking a foul blow, and his loyalty to his friends, which gives a glow and warmth to his style, in standing up for such a man as Darwin for example ; and besides that, the unflinching love of truth, the hatred of throwing dust in other people's eyes or letting it obscure his own, and, finally, what has been most truly noticed already, his strong preoccupation with the greatest and deepest problems of the time which, however they may be solved, whether in his sense or any other, require to be approached in a manly, serious spirit, as he always approached them. These, as I take it to be, very shortly are the mental and moral qualities which will give to Huxley's writings a place not only in science, but in the best kind of English literature, and in that faith it gives me the greatest pleasure to be allowed to have the honour of seconding this motion.

The resolution was then put and carried.

Mr. Alma Tadema moved the third resolution :—

"That the persons named in the list which has been circulated do form a General Committee, and that the following twenty persons be selected to form an Executive, with power to elect its own Chairman, and to add to the number of the General Committee :—

SIR W. BESANT.
SIR J. DONNELLY, K.C.B.
SIR J. EVANS, K.C.B., F.R.S.
SIR J. FAYRER, K.C.S.I., F.R.S.
SIR W. H. FLOWER, K.C.B., F.R.S.
PROF. M. FOSTER, F.R.S.
PROF. E. FRANKLAND, F.R.S.
SIR A. GEIKIE, F.R.S.
SIR J. HOOKER, K.C.S.I., F.R.S.
PROF. E. RAY LANKESTER, F.R.S.
SIR J. LISTER, BART., P.R.S.
PROF. J. N. LOCKYER, C.B., F.R.S.
LORD RAYLEIGH, F.R.S.
MR. BRITON RIVIERE, R.A.
DR. P. L. SCLATER, F.R.S.
LORD SHAND.
SIR H. THOMPSON.
MR. SPENCER WALPOLE.
THE RIGHT HON. SIR J. LUBBOCK, BART., M.P., K.C.B., F.R.S., *Hon. Treasurer*.
PROF. G. B. HOWES, *Hon. Secretary*."

He said :—It would be presumptuous in me, a painter, after all you have heard and all you know about the departed friend, to say any more to you as to why humanity owes so much to that giant of science. But you know that, in England, science and art are merged together. We have our department, and so I have a certain right to say a few words. As it has been already so rightly remarked, Prof. Huxley was a man of innate worth and energy : when you were in his presence you felt as if you were sitting in the sunshine, and sunshine is the life of an artist. Besides that, he loved art, and art flowed in his blood, as you know so well, because one of his daughters was a first-class artist.

Sir Andrew Noble seconded the resolution, which was carried unanimously.

Prof. G. B. Howes (Joint Honorary Secretary of the Provisional Committee) announced that the sum already received in donations to the memorial was £213, and that £344 more was promised, making a total of £557. The donations included £100 from Andrew Carnegie, Esq. ; £100 from J. Allsop, Esq. ; and £50 from the Marquis of Salisbury.

Sir John Evans proposed that a hearty vote of thanks be given to his Grace the Duke of Devonshire for his kindness in presiding at the meeting.

Sir J. Fayrer seconded the resolution, which was carried unanimously.

The Duke of Devonshire, in reply, said :—I can only say I am very much indebted to you for the cordial vote of thanks you have been so good as to pass to me. I need not repeat what I said in opening these proceedings—that I feel as fully as any one present can possibly do how entirely deficient I am in any claims of a personal character to occupy the distinguished position for which I have been selected. I think, however, it is perfectly right that some member of the present Government of the country should be associated with a movement of such national interest and importance as the present one, and I am aware that, as the Minister

who is responsible for the Education Department of Government, I am, perhaps, officially designated for this position. I need hardly say that I shall find it somewhat difficult to give very constant attention to the duties which will devolve upon the Committee. I trust, however, that the General Committee will be relieved of any work of a detailed character by the Executive Committee which you have just appointed. However, I can only assure you that any further services which I am able to give to this cause will be very cheerfully rendered, and I think I may conclude by congratulating you on the character of the proceedings which have taken place this afternoon. I assure you I feel it a very high honour indeed to have been permitted to preside on such an occasion, and over a meeting containing so many distinguished persons as those who have assembled here this afternoon.

The meeting then adjourned.

Since the meeting of the General Committee, two meetings of the Executive Committee have been held. At the first of these, at which Lord Shand accepted the office of chairman, it was reported that a number of foreigners of eminence had expressed a wish to be associated with the proposal to commemorate Mr. Huxley's distinguished services to humanity. It was resolved, in the first instance, to invite subscriptions from the members of the General Committee. At the second meeting, held on Wednesday last, it was reported that the subscriptions, which at the general meeting had amounted to £557, had been increased to about £1400, and it was resolved that a wider appeal for subscriptions should now be made to the friends and admirers of Mr. Huxley amongst the general public. The Honorary Secretary stated that in America committees were in the course of being formed to promote the realisation of an adequate Fund. The Committee resolved to communicate, by means of a Sub-Committee of their number, with Mr. Onslow Ford, R.A., who had the advantage of being well acquainted with Mr. Huxley, in reference to the statue, which it is proposed should be erected beside those of Darwin and Owen in the Natural History Museum, South Kensington. The extent to which the Committee may be able to carry out the other intended objects of founding exhibitions, scholarships, and medals for biological research and lectureships, and possibly in assisting the republication of Mr. Huxley's scientific works, will of course depend on the subscriptions which may now be received. These may be sent to the Treasurer, Sir John Lubbock, or the Bankers, Messrs. Robarts, Lubbock, and Co., 15 Lombard-street, E.C.; or to the Secretary, Prof. G. B. Howes, Royal College of Science, South Kensington.

The amount received to December 20 was £1535.

The court of the Fishmongers' Company, in consideration of the eminent and important services rendered by Huxley to the cause of technical education, has agreed to give a scholarship of £60 per annum to the City and Guilds of London Technical College, Finsbury, to be called "the Fishmongers' Company's Huxley Scholarship," to be held for three years by any scholar who has given evidence of high scientific attainments, to enable him to proceed to the Central College at Kensington.

RELATIONS OF THE WEATHER BUREAU TO THE SCIENCE AND INDUSTRY OF THE UNITED STATES.[1]

IT is a matter of much pleasure to me that I am allowed the privilege of speaking at a joint session of this Association—representing as it does within the confines of its admirable organisation the scientific thought of our country. This is the Mecca towards which annually journey all those who wish, each to contribute his mite to the sum of human knowledge; each inspired with an ambition to add even one flickering ray to the great luminous orb which to-day is shedding the benign light of wisdom even unto the uttermost recesses of the earth; subduing the barbarous instincts of man, and warming and invigorating into life the better impulses of his nature. Thus is civilisation advanced, and thus is humanity elevated to higher and higher planes of existence.

I hope to be a worker in the ranks of this great army, and as the science of meteorology can hardly be said to have passed beyond the embryonic state, I feel that the realms of investigation are boundless, and that the opportunities are correspondingly great.

As the Chief of the greatest meteorological system in the world, and with the power to control, under the direction of the Secretary of Agriculture, not only its executive functions, but the lines of future scientific investigation, I fully realise the great responsibility that rests upon me, and that at the bar of public and scientific opinion I shall, in the years to come, justly be held to a strict accountability for my stewardship.

Before considering the lines of investigation which can consistently be prosecuted by the Weather Bureau, it will be well to note the law which perscribes the duties of the Chief.

By an Act Congress approved October 1, 1890, Sec. 3, Statutes at large, Fifty-first Congress, p. 653, it is provided:

"That the Chief of the Weather Bureau, under the direction of the Secretary of Agriculture, on and after July 1, 1891, shall have charge of the forecasting of weather, the issue of storm warnings, the display of weather and flood signals for the benefit of agriculture, commerce and navigation, the gauging and reporting of rivers, the maintenance and operation of sea-coast telegraph lines, and the collection and transmission of marine intelligence for the benefit of commerce and navigation, the reporting of temperature and rainfall conditions for the cotton interests, the display of frost and cold wave signals, the distribution of meteorological information in the interests of agriculture and commerce, and the taking of such meteorological observations as may be necessary to establish and record the climatic conditions of the United States, or as are essential for the proper execution of the foregoing duties."

It will be seen that the main object for the existence and continuation of this Bureau is to give warning of the approach of storms, and therefore that the proper line of investigation should be for the purpose of determining the true philosophy of storms. The goal to be striven for is the improvement of weather forecasts, and surely one of the pre-requisites to determine coming events is a thorough knowledge of existing conditions.

To those who have read every important treatise on meteorology, and who have studied every text-book on the subject, it is painfully patent that we are extremely ignorant of the mechanism of storms, of the operations of those vast and subtle forces in free air which give inception to the storm, and which supply the energy necessary to accelerate cyclonic action when formed, or to disperse the same when fully in operation. We know that great atmospheric swirls in the shape of high and low pressure areas alternately drift across the country at intervals of two or three days; that the atmosphere flows spirally into the cyclonic or low-pressure system and outward from the anti-cyclonic or high-pressure system, that the in-drawn east and south winds on the front of the storm are warm, and that the inwardly-flowing north and west winds are cold.

The theories of Redfield, Espy, Loomis, Ferrel, and others, teach that our great storms are composed of immense masses of air gyrating about a vertical or nearly vertical axis, drifting eastward, and at the same time drawing in warm easterly currents at the front, and cold westerly currents at the rear; that the commingling of these two as they rise to greater and greater elevations, near the regions of the cyclonic centre, throws down volumes of rain or snow; that as precipitation occurs with the ascending currents, the heat of condensation energises the cyclonic circulation; that the air at the centre of the storm is relatively warm, is rarefied by centrifugal force, and by reason of less density, rises to a great elevation, and in the upper regions of the atmosphere flows away laterally to assist in building up high-pressure areas on either side.

The high and low pressure areas are supposed to be carried eastward by the general easterly drift of the atmosphere in the middle latitudes, somewhat as eddies are carried along by water in a running stream.

But, unfortunately for the complete accuracy of these theories, the forecaster often finds heavy downpours of rain without any cyclonic circulation, and no convectional system in operation; again over immense areas of country, especially in the Rocky Mountain region, for many months in the year condensation occurs not at all in the warmer easterly currents flowing into the storm centre, but almost exclusively in the westerly portion of the storm area, where the cold north and west winds are flowing in.

Again, many investigators to-day have good reason to doubt

[1] Read before the American Association for the Advancement of Science, at the Springfield Meeting, by Prof. W. S. Moore, Chief of the U.S. Weather Bureau. (Reprinted from *Science*.)

that the centre of the storm is warm to any great elevation, or that cyclonic circulation obtains to the top of the air.

In outlining, in a rough and general way, the line of investigation which in my judgment promises to give the most prolific results, not only to the cause of meteorological science, but to the making of more accurate forecasts for the benefit of agriculture and commerce, I will say that we have been for years taking our measurements at the bottom of this great ocean of air, while the forces which cause the formation of storms, and which influence their intensity and direction of motion, operate at great elevations, or are extraneous to our earth. It therefore seems imperative that systematic exploration should be made of the upper air. Balloon ascensions should be made in the several quadrants of the cyclonic storm, and also at the centre thereof, especially when rain is falling and the barometric gradient is steep. It is especially important to know the level at which condensation ceases, the depth of the cloud stratum, the temperature gradient, the air pressure and humidity, to a height of four or five miles. Skilled aëronauts with complete and accurate instruments should be placed in the region of severest action at the season of the year when storms are most frequent. They should be held in readiness until the approach of storms typical of cyclonic action, and then from the central office, where the movement of the storm is being carefully watched on the daily synoptic chart, they should be given telegraphic orders to ascend, and their ascensions should be so timed as to secure accurate readings at great elevations throughout the several quarters of the storm. It is believed that information thus secured will establish something like an approach to the true philosophy of storms, in contradistiction to the very imperfect theories which too often are hastily approved as demonstrated principles. Instead of erecting a cumbersome superstructure upon the sand, let us endeavour to lay a corner-stone upon which to erect something exact enough to be called a science.

In winter the great high-pressure areas which constitute our cold waves should receive the same thorough exploration. Readings at Pike's Peak or Mount Rainier might be useful in this investigation, but they are too far removed from the general track of storms and cold waves to furnish the full information desired.

Upper-air explorations may be accomplished by a train of kites carrying automatic instruments, by captive kite-balloons which may be forced nearer and nearer the zenith with increasing wind velocity, or by the ascension of trained observers in free balloons. We must strive for the perfection of appliances and instruments which will, at no distant day, enable us to present to the forecaster the charted synchronous meteorological conditions prevailing at high levels and covering a great area. Mr. McAdie, at Washington, has secured recently some good records with kites at elevations from 1000 to 2000 feet.

Systematic exploration of the upper air, with a continuation of the studies begun by Prof. Bigelow of terrestrial magnetic forces as induced by the solar magnetic field, will be the line of investigation prosecuted during the next two years, and from which it is hoped that results satisfactory to the practical as well as the theoretical man may be obtained.

The Secretary of Agriculture is in thorough sympathy with all lines of research which can be legally carried on under the Act of Congress constituting the Weather Bureau, and which promise to give results useful to the people.

Harmonious co-operation between the practical worker and the scientific investigator is essential to success. Too often they have found themselves picking out diverging paths. In the future they will work on parallel and converging lines, and not far removed from each other, and the result, I am confident, will be beneficial to all. In a great system like ours, each worker must be justly recognised for the merit that is in him, whether he be a skilled scientist or an able executive officer, and he should be given his proper place as an integral part of the great whole which constitutes the efficient Bureau.

A brief retrospect of the forecast work may not be without compensating results in our efforts at future improvements.

Forecasts were begun in the United States about twenty-five years ago, and have, during the past decade, become of such benefit to the many and diversified interests of the country that, with one accord, the people now acknowledge their value, and applaud all efforts to improve and extend their usefulness. Fifty million dollars is a low estimate of the value of property placed in jeopardy by one West Indian hurricane sweeping up our Atlantic coast.

Predictions were first called "probabilities," and were made for districts, each comprising several States, and included a prediction as to the probable change in barometer. Later the prediction as to barometer was omitted. Forecasting by districts was soon shown not to be specific enough as to boundary, and the designations applied were not well understood by the people; hence forecasting by States was adopted.

Forecasts were made only at the Central Office at Washington, and the local observers were allowed to disseminate no other, nor to give public expression to any opinion of their own which might be construed into a forecast. Considering the very limited training of the observers, and the lack of all chartered meteorological conditions for their study and enlightenment, the wisdom of that regulation could hardly be questioned.

With the transfer of the Weather Bureau to the Department of Agriculture, came the inauguration of far more liberal and progressive ideas. The office of Local Forecast Official was created for such observers as had shown special fitness for forecast work, and they were assigned to duty at the more important agricultural, commercial, or maritime centres, with instructions to carefully study the local climatology of their sections, so that products that are indigenous to limited areas, or interests which are of special importance to particular sections, might have such application of the weather forecasts as the intimate personal attentions of a competent local official could give.

The changes enumerated have been carefully tested and found to be beneficent in purpose, and worthy of continued and permanent application. Thus has the forecasting system of to-day slowly developed during the past twenty-five years. Is it not the essential feature of the Weather Bureau? Is it not the nucleus around which all departments of thought and study must rotate and become auxiliary, if the original intent of Congress, made manifest by the establishment of a national storm-warning system, is to be carried forward to as successful an operation as the present knowledge of the physics of the air will permit? It is hoped that discoveries may be made relative to the controlling and modifying forces of storms which shall raise the standard of forecasting accuracy attained by our most expert officials, who have had all the benefits to be derived from many years of patient and intelligent observation of storms, from the time of their inception in, or entrance within our daily observed and charted territory, until they have been dissipated or have passed eastward beyond our range of vision.

It may be well to consider what class of forecasts can be most successfully made by our more or less empirical methods, the object being to extend the work along such lines of activity as promise the most beneficial results.

As to this proposition it is doubtless conceded by all that when pronounced high and low-pressure areas dominate the weather conditions and the changes in wind, temperature and weather are characterised by such force and degree as to render them destructive to lives and property, a forecaster of average ability and well-balanced judgment is able to make nearly or quite as accurate a forecast as when the air pressure is quite uniformly distributed and all changes of weather are so slight as to be of no importance.

If, then, a destructive frost or cold wave can be predicted as easily as a change of a few degrees in temperature, and if the coming of high winds and gales are as easily foretold as that of a gentle zephyr, it is evident which class of forecasts should receive the greater attention. The public care comparatively little for predictions of moderate changes, and but little credit attaches to the Bureau when such forecasts are verified; but when great heat, cold waves or violent winds are on the programme, a vital interest is felt in the subject, and the accurate forecasting of such conditions is the gauge by which the public measures the usefulness of the Bureau.

Horticulturists and the growers of tobacco and cranberries realise the vast benefit to be derived from accurate frost predictions, and I will give a brief statement of what I believe to be original ideas introduced into the making of frost forecasts while in charge of the State Weather Service of Wisconsin, a State including within its domain the largest area of cranberry marshes in the world, and also including an extensive area devoted to the cultivation of tobacco. Heretofore I believe that only the air conditions have been taken into consideration in the making of frost forecasts—such as pressure, temperature, relative humidity, cloudiness, and wind velocity. As a result of my investigations, systematically prosecuted for three years, I found that the conditions of the soil were equally as important as those of the air.

When the high-pressure area is moving in from the west, clear and colder weather anticipated, with the probability that the early morning temperature will permit the formation of frost—the most important elements to be considered, in determining whether or not frost will occur injurious to growing crops—are as follows:

(1) Has rain recently fallen, and what is the condition of the soil relative to the amount of moisture contained?

(2) What are the natural properties of the soil relative to the slow or rapid loss of heat by radiation?

(3) To what degree of heat has vegetation been subjected during the period immediately preceding?

The early fall frost injurious to tender crops occurs with the observed town or telegraph minimum temperature ranging from 40° to 50°, because, when the early morning temperature in the town falls much lower than 40°, it is usually so late in the season that all crops are gathered, or, if not gathered, they have been destroyed ere this condition arrives. At the time, then, that frost-warnings are of the most benefit, we have to deal with the air at temperatures considerably above the freezing-point, and to recall that a deposition of frost requires that the temperature of the top soil, or that of vegetation, be reduced to the freezing point. This, of course, is accomplished by conduction and radiation of heat, which takes place more rapidly from the soil and vegetation than it does from the lower stratum of air to the higher.

Anything that will seriously interfere with a rapid loss of heat after nightfall will tend to prevent the formation of frost. Moisture does this, and if the soil be well charged it partakes greatly of the stability of water as to temperature, and cools but little, if any, below the temperature of the superincumbent air, and no frost will occur even though all other favourable conditions of clearness, gentle winds, and cool air obtain. Even a small amount of moisture, say one-half inch of rainfall, will give ample protection if well distributed and precipitated within the twenty-four hours previous. But when severe drought conditions are prevalent, injurious frosts may occur when the telegraphic temperatures do not show a reading within ten degrees as low as in the first case.

I believe that, when estimating the probability or severity of frost, sufficient weight has not been given to the dryness or wetness of the soil, and the resultant dissipation or conservation of heat, and I call special attention to the point as one of the means for improving the forecast.

I have in mind two typical cases. In the first a high-pressure area attended by clear and cool weather drifted from the westward until it covered the State. No rain had fallen with the passage of the low-pressure area immediately preceding it; hence the ground was in excellent condition for the rapid loss of heat during the night, and a consequent lowering of the temperature of vegetation to the freezing point. Considerable damage was done to cranberries in unflooded marshes. In the second case a high-pressure area of slightly greater weight and slightly lower temperature covered the region about ten days later, but it was preceded within a few hours by a light but well-distributed fall of rain, averaging about one-half an inch, and no frost occurred. In both cases the wind was gentle from the north-west, and the nights were clear. With slightly lower air temperature and higher barometer in the second condition, heavier frost would have occurred than in the preceding case, had it not been for the thinly spread moisture of the timely rain conserving heat at the surface of the earth.

Might not this principle be carried further in the improvement of the forecast? Assuming that the caloric energy of the sun is a constant factor, the earth receives each year the same amount or intensity of heat, and as the atmosphere is warmed mainly by contact with or radiation from the earth, seasonal variations of temperature which are marked departures from the normal might result from abnormal terrestrial surface conditions with respect to the conservation of this constant solar energy over large continental areas. Here the excessive or deficient rainfall during the preceding seasons should receive careful consideration. The subject is one that requires deeper and more detailed investigation than the length of this paper will permit.

I find that the minimum temperatures in cranberry marshes during abnormally dry seasons often fall 15° below the temperatures telegraphed from the cities and towns within a few miles of the marshes. This is due to the fact that when the loose, spongy peat, of which the marsh is composed to the depth of several feet, has dried out, the radiation of heat during the night is very rapid, and is not counterbalanced by conduction and connection from the marsh. The temperature, therefore, in cranberry marshes is at all times much lower than that which obtains in marshes composed of heavy black muck, where it preserves a more equable condition, such as is common to air resting over a considerable body of water. A dry cranberry marsh does not, therefore, enjoy that immunity from frost enjoyed by wet marshes and watery lands. But when the ditches are flooded from the reserve water supply on receipt of a frost warning, the water quickly percolates through the peat composing the marsh, and the rapid loss of heat by radiation is checked and the frost averted.

The amount of heat to which vegetation has been subjected immediately before the frost condition, and the temperature under which it had made its growth, will in a great measure determine the extent of damage to ensue.

By carefully considering the principles herein enunciated, I will say that in 1894, twelve out of fourteen official forecasts of frost were fully verified—a much greater percentage of accuracy than has ever been attained by simply considering air conditions alone.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

ON Friday, the Chancellor of the Exchequer received at the Treasury a large deputation in support of a memorial praying that increased aid may be given to the English University Colleges, ten in number, and to University College, Dundee, which at present receive among them an annual grant of £15,000. Sir M. Hicks Beach, in reply, said there was no question that the existing grant of £15,000 would be continued; but he thought that in accordance with the recommendations of two Parliamentary committees a competent inspector should be appointed to visit annually each college receiving a grant, and report on its efficiency, its success, and its financial position. Till such an inspector should have reported, he did not think it possible for him to consider the increase of the grant.

IT is satisfactory to be able to note that the question of the education of mine managers, assayers, and engineers in Australia is actively discussed in the most recent Government reports on mines for several of the Colonies. In Victoria, mining schools have long been established at Ballarat and Bendigo, with branches at the more important mining centres in the Colony. Certificates of competency to act as mine managers are given by these schools, although the holding of such by mining engineers is not compulsory by law. In like manner in Tasmania, similar certificates are given after a Governmental examination. As the Under-Secretary for Mines of Queensland observes in his latest annual report, "the implication is that a certificated mining manager is preferable in the eye of the law to one who has no such credentials." In 1893 a school of mines in connection with Sydney University was founded by the New South Wales Government, and £10,000 spent in the erection of a suitable building, which has just been completed. The teaching staff has been formed at a small cost by utilising the services of the professors paid by the University, and lectures and practical instruction are now being given in chemistry, metallurgy, assaying, geology, mineralogy, and all branches of mining to an increasing number of students. Up to the present Queensland alone, among the more important Colonies, has established no mining school; but, State aid having been promised to well-supported schemes in any mining centre, the reproach will probably soon be removed. Indeed, some progress has already been made towards establishing a technical school at Brisbane. With regard to the effect of such schools, the Under-Secretary of Mines for New South Wales remarks, in his Report for 1894: "It is hoped that the establishment of the School of Mines will result in the gradual improvement in the methods of mining, as practised in this Colony, by providing a class of managers who will have had the advantage of a thorough scientific training, and who will only need a few years' practical experience to qualify them as mining engineers of the highest efficiency. The ultimate result must be an increased development in the mining industries of this country." In view of this feeling on the part of the Government officials of the various Colonies, it is evident that the compulsory possession of a certificate of competency by Australian mine managers is almost within sight.

SCIENTIFIC SERIALS.

American Journal of Science, November.—On the wave-length of the D_3 helium line, by A. De Forest Palmer, jun. The definition and intensity of this line varied greatly from day to day. The best combination of intensity and definition was obtained by avoiding prominences and working only on very clear days. The average for seventeen series of measurements was 5875·939 ± ·006.—Some additional notes on argon and helium, by Edwin A. Hill. The conclusion that argon is monatomic depends upon the correctness of three assumptions, viz., that a gas, with little or no rotational energy, must be monatomic; that the ratio of the two specific heats of 1·67 proves the gas to have no rotational energy; and that the ratio of the two specific heats is correctly determined. In choosing between the two alternatives of a diatomic gas without rotational energy or a free atom devoid of chemical affinity, the presumption is strongly raised that it is not a monatomic gas, but diatomic and chemically inert because the two atoms of the molecule are very strongly bound together. There is not much doubt that helium is a mixture, and if anything can be argued from the analogies between argon and helium, argon is a mixture likewise.—Recent progress in optics, by W. Leconte Stevens. Part II. This concluding portion of the presidential address deals with colour photography, with recent researches on the spectrum and on polarised light, and with colour sensation.—Effect of the mutual replacement of manganese and iron on the optical properties of lithiophilite and triphylite, by S. L. Penfield and J. H. Pratt. The transition from $LiMnPO_4$ to $LiFePO_4$ is marked by a considerable change in the optical characters of these isomorphous minerals. With an increase in iron there is an increase in the indices of refraction, and also the divergence of the optical axes changes rapidly.—The reduction of selenic acid by hydrochloric acid, by F. A. Gooch and P. S. Evans, jun. A solution of selenic acid is boiled in hydrochloric acid, and if the solution is not too dilute the reduction is obtained in a few moments. The hydrochloric acid must form at least 30 per cent. of the entire solution. The solution should be boiled until all the chlorine is expelled, but must not be allowed to fall below two-thirds of its original volume.—Reduction of selenic acid by potassium bromide in acid solution, by F. A. Gooch and W. S. Scoville. When intermixed with sulphuric acid and potassium bromide, selenic acid liberates bromine in proportion to the excess of acid, the bromide, and the elevation of the temperature. On boiling, the bromine is evolved and may be collected in potassium iodide, and the iodine thus set free may be determined by standard sodium thiosulphate and taken as the measure of the bromine distilled.—Restoration of some European Dinosaurs, with suggestions as to their place among the Reptilia, by O. C. Marsh. The geological positions of *Compsognathus* and *Scelidosaurus* are fully determined, but that of *Hypsilophodon* and *Iguanodon* is not so clear. The latter are found in the Wealden, which is usually considered to be Cretaceous, but might as well be classified as Upper Jurassic.

THE numbers of the *Journal of Botany* for November and December are chiefly occupied with papers on descriptive botany. Mr. D. Prain completes his account of the genus *Argemone*, and Herr R. Schlechter his *Asclepiadaceæ Elliotianæ*, and describes also two new genera of the order, from Madagascar and from Angola.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, November 21.—"On the Gases obtained from the Mineral Eliasite." By J. Norman Lockyer, C.B., F.R.S. (Received August 6, 1895.)

Observations have been made of the gases obtained from the mineral eliasite heated *in vacuo*, in the manner which I have described in a former paper,[1] and, in addition to lines of known gases, others have been noted, for which no origins can be traced, at the following wave-lengths:—

Ångström.	Rowland.
6121·4	6122·4
6064·6	6065·7
5990·2	5991·2
5874·9	5875·9 (D_3)
5845·7	5846·7
5428·8	5429·8
5403·1	5404·1

[1] *Roy. Soc. Proc.*, vol. lviii. p. 68.

The wave-lengths of these lines have been determined by means of a Steinheil spectroscope having four prisms, comparisons being made with adjacent metallic lines, and the positions interpolated by micrometric measurements; the accuracy may perhaps be taken to be within 0·1 tenth metres. Other lines have been noted, but they are not included in the list, for the reason that their wave-lengths have not yet been determined with the dispersion stated above.

Of the lines in the foregoing list, six are in all probability coincident with chromospheric lines, as shown in the following table, which also indicates the frequencies and brightnesses of the lines according to Young:—

Wave-length of Chromospheric Lines.

(Angström's scale).	(Rowland's scale).	Frequency.	Brightness.
6121·2	6122·4	5	3
6064·5	6065·7	5	2
5990·0	5991·6	10	4
5874·9 (D_3)	5875·9	100	90
5428·8	5429·9	8	3
5403·1	5404·1	5	3

It is important to point out that all these lines do not appear in the spectrum at the same time. For instance, in the first two specimens of the mineral no trace of D_3 was noted, but in the third portion examined, all coming from the same specimen, D_3 appeared as a pretty bright line. Again, as in the case of a previous operation on bröggerite,[1] in one experiment with eliasite the products of distillation, collected in four stages, gave different spectra.

These facts seem to indicate that the gas obtained from eliasite is either a compound or a mixture of gases, just as is that obtained from bröggerite according to former experiments.

It is also to be remarked that among the lines in the eliasite spectrum, those at 6122·4 and 6065·7 have been recorded in the gases obtained from cleveite, and 6122·4 has also been noted in the gas obtained from gummite.

It seems to be more than probable, therefore, that the lines observed in eliasite indicate a new gas, in some way associated with those given off by cleveite and bröggerite, and the fact that D_3 is not necessarily present in the spectrum, furnishes an additional argument in favour of the view that the gas obtained from cleveite or bröggerite is complex.

Addendum. Received November 18.

The results in the foregoing paper depend upon eye observations on the red end of the spectrum. Since it was communicated to the Society the blue end has been investigated photographically. Many specimens of eliasite have been distilled, and numerous photographs of the spectra of the gases given off have been taken.

The work has been rendered difficult by the very small quantity of what I believe to be a new gas, and the large quantity of carbonic acid, nitrogen, and hydrogen given off from the mineral. Attempts have been made to get rid of the known gases, in order to make the lines in the new gas better visible, and then the amount of gas was in most cases very small and at times admixed with argon produced by the sparking.

The photographs have been measured and reduced, and it is probable that the lines, or some of them, which cannot be ascribed to any known gases, may belong to the same gas as that giving the lines observed in the red. I append a table of some of these lines, which suggest possible coincidences in stellar and solar spectra; the numbers in brackets indicate the intensities of the lines, 6 being the maximum in the case of α Cygni, and 10 the maximum in the case of the eclipse spectrum.

Wave-lengths (Rowland).	Coincidences.
3961·4	α Cygni (6)
4035·2	Eclipse (2)
4058·6	,, (1)
4128·3	α Cygni (3)
4131·4	,, (3)
4224·0	Eclipse (1)
4255·7	,, (1)
4442·5	,, (3)

[1] *Roy. Soc. Proc.*, vol. lviii. p. 194.

In addition to the above lines there are others with which no celestial coincidences have been traced.

Some of the unknown lines at first noted in the red have been observed again in the gases obtained from other specimens; it is important to note that remarkable variations in the spectra have been observed in passing from one specimen to another.

Although the evidence in favour of a new gas is already very strong, no final verdict can be given until the spectra of all the known gases, including argon, have been photographed at atmospheric pressure and the lines tabulated. This part of the inquiry is well in hand.

November 28.—"Examination of Gases from certain Mineral Waters." By Alexander Kellas and Prof. William Ramsay, F.R.S.

A sample of gas of an inflammable nature from "Allhusen's Well," Middlesbrough, was tested for argon. The usual constituents, nitrogen, hydrocarbons, &c., were removed by the usual absorbents, magnesium, copper oxide, &c., and finally by sparking with oxygen over caustic soda. The spectrum of the residue was carefully compared with that of argon, and the lines were all found to be coincident. No new lines appeared, nor was any helium yellow visible. An incombustible gas from another well at the same place was also tested, and was found to contain 0·5 per cent of argon.

Some gas from a boiling spring near Reykjavik, Iceland, was found to contain a greater proportion of argon than is present in air, viz. 1·14 per cent. No helium could be detected in the gas, nor were there any lines which could not be recognised as belonging to argon.

"On the Percentage of Argon in atmospheric and in respired Air." By Alexander Kellas.

Experiments were made on the comparative amount of argon in ordinary air, and in air which had been frequently breathed, with the view of ascertaining whether, if the proportion of oxygen and carbon dioxide in air be very much altered, argon would either enter into, or be expelled from, the respiratory system. The experiments show that the proportion of argon to nitrogen remains nearly normal, even when the air has been greatly altered in composition by respiration.

From the experimental results it appears that 100 c.c. of nitrogen and argon of breathed air contains 1·210 c.c. of argon. This percentage is larger than that in normal air. One of two suppositions may be made: either the increased amount is due to the air having been confined over water during breathing, or argon is given off from blood in greater amount than it is absorbed, when the composition of the air in the lungs is so much altered; the former appears the more probable supposition. In any case the difference is not great; and it would appear that argon, like free nitrogen, plays no important part in the animal economy, save as a diluent.

Linnean Society, November 21.—Mr. J. G. Baker, F.R.S., Vice-President, in the chair.—His Grace the Duke of Bedford, Messrs. Bernard Arnold and E. B. Fernan were elected Fellows of the Society. Mr. B. B. Woodward was admitted.—The Rev. G. Henslow exhibited a MS. common-place book of the latter end of the fourteenth century. The entries in Latin and English were found to consist chiefly of medical recipes in which about 200 plants are named for their user, and some methods of distilling *Aquæ vitæ* described. In addition were some notes on geometry and astronomy, and calculations of altitudes and superficies. Mr. Baker thought the number of plants named at the date referred to was a matter of some interest to botanists, and suggested publication of the list of names with their identification where possible.—Mr. Henslow also exhibited a series of shells of *Buccinum undatum* and *Fusus antiquus*, showing the variation in form which occurs in the reparation of injury sustained at an early stage of life, the subsequently renewed whorls assuming shapes resembling those of other species in the same genus, and even in other and very different genera. Usually the uninjured whorls could be detected by the apex being of the normal character; but in some cases the abnormality appeared to be congenital, being carried completely into the ape. This raised the question whether these were acquired characters and hereditary, having been impressed upon the offspring born after the parent shell had been injured, and renewed by growth. Mr. E. R. Sykes and Mr. B. B. Woodward offered some criticism in the discussion which followed, and deprecated the suggestion of anything like "mimicry," the resemblances in question being regarded as purely accidental.—Mr. T. H. Buffham exhibited lantern slides of a red marine alga, *Bonnemaisonia hamifera*, Hariot, found floating in the sea at Falmouth. This species, recorded previously only from Japan, bears thickened branches terminating in a hook (hence the specific name), in this respect resembling *B. californica*, Buffham, which was also shown. Various microscopic characters of each were described and compared with those of *B. asparagoides*, Ag. It was suggested that if *B. hamifera* had been introduced from Japan, it could only have been from spores, or possibly the hamose branches might develop into plants, since the Falmouth specimens were quite fresh, and must have been living near the place of discovery.—Remarks on the mode of distribution of algæ were made by Mr. George Murray and Mr. E. A. Butters.—Dr. D. Morris, C.M.G., read a paper on the development of a single seed in the fruit of the cocoanut palm (*Cocos nucifera*). Alluding to the occurrence of palms with twin and trifid stems arising from one base, it was shown that these were due (1) to several seeds in one fruit; (2) to more than one embryo in a seed; or (3) to a branching of the primary shoot. In cases cited by Rumphius, Forbes and others, several seeds were found in one fruit. The course of the development of the single cell was illustrated by means of lantern slides. The obliteration of the two cells began about the second or third week after the spathe was open. By the end of the seventh week they were reduced to narrow slits, which were still traceable in the mature fruit.—On behalf of Mr. A. J. Ewart, Prof. Harvey Gibson gave an abstract of a paper on assimilatory inhibition, the causes by which it may be induced, and their influence on vitality. It was shown that most inhibitory agencies operate by inhibiting the initial stages in assimilation, but any cause affecting the rapidity of removal of carbohydrates from assimilatory cells will also affect their power of assimilation, the commencement of which is determined mainly by the development of the chlorophyll pigment, but is also influenced by other indeterminate factors probably plasmatic in origin. The paper dealt mainly with the discussion of experiments with a large number of plants, and criticism of the results arrived at by other investigators. An interesting discussion followed, in which Dr. Scott, Prof. Reynolds Green, and Prof. Weiss took part.—Mr. A. C. Seward gave the substance of a paper on a new species of *Pinites* from the Wealden (England).

The Institution of Civil Engineers, December 17.—Sir Benjamin Baker, K.C.M.G., President, in the chair.—The design and testing of centrifugal fans, by Mr. H. Heenan and Mr. W. Gilbert. The object of the experiments recorded in this paper was to determine the best form of fan-blade and fan-case, and the most economical diameter and speed of a fan, to produce any required volume of air at a given pressure. The comparative output of fans of the same type, but differing in size, showed that, if they were run at the same tip-speed and produced the same water-gauge, the air-discharge would be proportional to the centre section of the fan, that was, to the diameter multiplied by the width. A series of tests made to determine the efficiency of an expanding chimney was also described. Air was passed from a fan through a delivery tube into an expanding chimney, the sides of which could be set at any desired angle to the centre line of the tube. The efficiency for any angle was obtained by dividing the vacuum observed at the throat of the chimney, by the calculated vacuum due to the reduction of velocity of the air as it passed from the inlet to the outlet of the chimney. The results of the tests showed that the angle on each side might be as much as 15° without loss of efficiency. The air speed recommended at the chimney outlet was 20 feet per second, and the efficiency with this speed varied between 0·43 for 6° opening, and 0·42 for 15° opening on each side.

Mineralogical Society, November 19.—Anniversary meeting.—Prof. N. S. Maskelyne, F.R.S., in the chair.—The following officers and members of Council were elected: President, Prof. N. S. Maskelyne, F.R.S.; Vice-Presidents, Rev. S. Haughton, F.R.S., Dr. Hugo Müller, F.R.S.; Treasurer, Mr. F. W. Rudler; Foreign Secretary, Prof. J. W. Judd, F.R.S.; General Secretary, Mr. L. Fletcher, F.R.S.; ordinary members of Council, Prof. Green, F.R.S., Mr. Harker, Prof. Lewis, Mr. Pringle, Mr. Prior, Mr. Thomson, Mr. Tutton, Mr. Watts, Prof. J. Geikie, F.R.S., Mr. Hutchinson, Mr. Kitto, Lieut.-General C. A. McMahon. Mr. J. H. Collins was elected an auditor in place of Mr. F. Rutley, resigned. The Rev. Mark Fletcher and Mr. R. C. Webb were elected members of the Society.—Mr. Wm. Barlow read a paper on homogeneous structures and the symmetrical partitioning of them, and

exhibited models, manufactured by himself, to illustrate the manner in which various types of cubic symmetry can be constructed from units composed of any material distributed in the least symmetrical manner compatible with the requirements of that system. The models were hollow cubes, each containing three small hands affixed to one diagonal, right hands in some cubes and left hands in others. The author insisted upon the desirability of regarding the problem as one of the homogeneous distribution of matter without any limitation as to the form of the units, herein placing himself in opposition to the recently expressed views of Fedorow, who regards parallelohedra as the basis of all crystalline structures.—Prof. A. S. Herschel exhibited a number of intricate coloured models, made by himself, to illustrate the symmetrical partitioning of space, and indicated the various ways in which they may be viewed as interpenetrating or juxtaposed compartments. In the discussion which followed, Mr. Tutton agreed with Mr. Barlow's conclusion that the space-units should not necessarily be endowed with the same symmetry as the whole solid, and suggested an analogy between the author's conception of a growth of the hands whereby they might meet and fill the space with close-packed units, and the growth in volume which may occur when one metal in a salt is replaced by a heavier one of the same series. The President observed that such space-partitioning surfaces are purely imaginary; their form and dimensions must vary with temperature-changes, &c. The morphology of crystals has had nothing to learn from the geometry of crystal tactics; on the other hand, it has corrected and guided the course of those geometrical inquiries. The future working-out of the relations of stereo-chemistry to morphology and to actics will give significance to the stereohedra and parallelohedra of Fedorow, and will perhaps explain the existence of planes of symmetry, a principle which underlies any true theory of crystal-structure.

PARIS.

Academy of Sciences, December 16.—M. Marey in the chair.—On a theorem in geometry, by M. J. Bertrand.—The composition of flour and other products of roller milling. This is an attempt to place the operation of milling upon a scientific basis. The products of the fining were separately weighed and analysed, and samples of bread made from each.—Observations on Brooks' comet (1895, November 21) made at the Paris Observatory, by M. G. Bigourdan.—Observation of a meteor, by M. G. Bigourdan. A very brilliant meteor seen 7h. 4m. 50s. p.m., December 15. It appeared to be moving very nearly horizontally at a height of 45° in the direction from east to west.—A new explanation of the phenomenon of the solar prominences, by M. J. Fényi.—The equation to derived partials with constant coefficients, and on non-analytical functions, by M. E. Borel.—On the rolling of two surfaces on each other, by M. E. Cosserat.—Measurement of the force acting on a non-electrified dielectric, placed in an electric field, by M. H. Pellat. An experimental proof of a theorem established in a previous note.—The direct combination of nitrogen with metals, by M. A. Rossel. It has been found that if an intimate mixture of finely-powdered calcium carbide with magnesium powder is heated with free access of air, the metal is almost completely transformed into the nitride. Finely divided aluminium, zinc, iron, and copper act similarly.—On the preparation and properties of crystallised chromous sulphide, by M. A. Mourlot. Metallic chromium was heated to a high temperature in a stream of sulphuretted hydrogen. The product proved to be the protosulphide, which on strongly heating was obtained in the crystalline state. A study of its behaviour towards a number of reagents showed that it is a compound of considerable stability.—On lithium subchloride, by M. Guntz. This is prepared by heating lithium and the ordinary chloride together to a red heat. The product decomposes water with the liberation of hydrogen.—On some new saffranines, by M. G. F. Jaubert.—Study on *Aspergillus oriza*, by M. E. Sorel. It is shown that if cultures of the conidia in malt-wort are subjected to certain temperatures, and in presence of hydrofluoric acid, the mycelium first produced breaks down into a yeast-like form capable of isolation by repeated cultivation in malt-wort. This yeast is active, and whilst fermenting an ordinary malt solution produces no mycelium. The latter, however, can be reproduced again under special conditions, thus completing the life cycle.—Functional assimilation, by M. F. Le Dantec.—On the process of development in the Filigranes and Salmacynes, by M. A. Malaquin.—On the influence of electricity on the development of the embryo of the chicken, by M. C. Dareste.—Study of the effect of the colour of light upon vegetation, by M. C. Flammarion.—On some vegetable impressions in the coal-measures of Southern Brazil, by M. R. Zeiller.—A new disease in the leaves of the larch, by M. E. Mer.

NEW SOUTH WALES.

Linnean Society, October 30.—Mr. Henry Deane, President, in the chair.—On the occurrence of diatomaceous earth at the Warrumbungle Mountains, N.S.W., by Prof. T. W. Edgeworth David.—Jottings from the Biological Laboratory, Sydney University, No. 18.—On certain points in the structure of the pearly nautilus, by Prof. W. A. Haswell.—The grey gum of the North Coast districts (*Eucalyptus propinqua*, sp. nov.), by Henry Deane and J. H. Maiden. This grey gum has for many years held an uncertain botanical position, having been ranked, at different times, by botanists under *E. punctata*, *E. saligna*, and even *E. viminalis*. The authors believed that it but perpetuates the confusion to place it under any existing species. Its bark and timber considerably resemble those of *E. punctata*. From this species *E. propinqua* differs in the smaller size of the flower-buds and fruits; and in the narrow lanceolate leaves which also have more parallel and less prominent lateral veins than *E. punctata*. The calyx-tube and also the operculum of *E. propinqua* are more distinctly hemispherical, and its flowers more pedicellate. The fruit of *E. punctata*, though variable in size, is always larger and more cylindrical than that of *E. propinqua*. *E. propinqua* was fully described, and its affinities and differences from other species were further given in some detail. The species is found from the Hawkesbury River to the Tweed River, and probably will be found to extend to South Queensland.—On new localities for *Peripatus*, by Edgar R. Waite.

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