THURSDAY, FEBRUARY 5, 1885

SIR HENRY COLE

Fifty Years of Public Work of Sir Henry Cole. Two vols. (London: George Bell and Sons, 1884.)

THIS book, though chatty and discursive enough in parts, will disappoint those who want to learn something of the personality and life of a doughty champion of some dozen reforms. The first part, from the racy pen of Sir Henry Cole himself, teems with lively comments and thrusts, *more suo*. The vigour of a man who believed in his mission, and rejoiced in the work of his own hands, appears on every page. No mark is required to indicate the transition from the dashing, animated narrative of the chief actor to the careful and cautious chapters written by his children. We do not see how either could give us what we chiefly want without offending against certain rules of delicacy which we are glad to know are not yet quite obsolete. The life of Sir Henry Cole, the inner history of his struggles, his successes and failures, the motive power, and an impartial view of the man in relation to his work —this has yet to be written. What he and his children between them have given us is a valuable collection of facts and documents bearing upon the most important progressive movements of our century.

To not a few the second volume will be more interesting than the first. The plan of the work is to give in the first volume a series of chapters which take in Sir H. Cole's principal work, and the corroborative and supplementary documents, with many curious illustrations, make up the second volume. The whole concludes with a most thoroughgoing verbal index, which would have rejoiced Sir Henry Cole's heart, for to him nothing was complete without an index.

Henry Cole had to face no ordinary difficulties in carrying out his work, but then he was just the man for difficulties. He would have been nowhere in piping times of peace. His appetite for a task grew as the opposition and hindrances grew. Probably no one ever knew him to be faint-hearted or broken in resources. At last it came to be felt that he would in any case carry his point, and timid natures gave way before the impetuosity of a knight whose sword had no scabbard, and who left himself no retreat. You could only beat him by cutting him to pieces—there was no other way. At the Paris Exhibition of 1855 he was known to the officials as *ce terrible Cole*—a man who, regardless of the methods of red tape, took the shortest way to his point, and did not know when he was beaten by all the rules of officialism.

Associated with this indomitable pluck was another quality which the English people love well. He had a never-failing flow of good spirits which burst forth in rollicking good humour, confusing and sometimes irritating to his opponents. We suspect that not a few of the enemies he made had suffered in their self-esteem from the sharpness of his common sense driven home by his reckless love of fun—at least of what was fun in him. Once, when giving an address, in a provincial town, on public libraries, as he was advocating the setting up of reading-rooms where smoking would be allowed, a local magnate on the platform testily interrupted him with a formal protest and the remark that there was a public-house across the road. Sir Henry Cole, pausing in his discourse, surveyed his critic for a moment with a curious air, and then, turning to the audience, said in a loud "aside" and with the most perfect good humour:—"This gentleman seems to be a kind of pope down here." The cause of his antagonist collapsed amidst inextinguishable laughter. On another occasion the Education Code was under consideration, and one, not remarkable for hereditary wisdom, suggested that the poor children should be taught "legal economy," meaning thereby, as was explained, a knowledge of the laws of the land,—"And the Ten Commandments," interpolated Sir Henry Cole in a stentorian voice. People do not readily forgive such setting forth of their folly, but it was a temptation which an impulsive enthusiast could not resist.

In the short space allotted to this notice it would be unwise to indulge in extracts. If we take one, it is because it sets forth in Sir Henry Cole's own words the works of a public nature with which he was connected.

"The principal subjects which I now deal with are the reform of the system of preserving the inestimable public records of this country, dating from the time of the Norman Conquest, and unrivalled in Europe; my work in expediting the successful introduction of Rowland Hill's penny postage; the administration of railways; the application of fine art to children's books and then to manufactures, which led to the transfer of my duties to the Board of Trade; the Great Exhibition of 1851, and its successors; the reform of the Patent Laws; the establishment of schools of art and science classes throughout the United Kingdom; the South Kensington Museum; drill in public elementary schools as the basis of a national army; national training schools for music and for cookery; the Society of Arts, and public health."

To begin with the public records. Entering this office as a mere youth, his spirit was stirred within him when he saw the utter carelessness as regards documents "dating from the time of the Norman Conquest and unrivalled in Europe." For daring to call attention to the jeopardy in which these precious records were placed he was dismissed, and no doubt it was thought the insignificant youth was extinguished; but in the end young Cole dragged the affair before Parliament, and was triumphantly reinstated with something like full powers to carry out the much-needed reform. Our Public Records Office is now a credit to the administration of the country, but fifty years ago (so it was stated in Parliament) public records were boiled down for glue, and the clearer and better sort converted into jellies by the confectioners (Mr. Charles Buller's speech on Public Records, vol. ii. p. 86).

While at the Records Office, Henry Cole threw himself into the uniform penny postage movement. The particular task he undertook was to rouse popular enthusiasm for the reform, and we have Sir Rowland Hill's testimony that "he was the author of almost innumerable devices by which in his indefatigable ingenuity he contrived to draw public attention to the proposed measure." There is an amusing cut in the book (vol. ii. p. 102) representing one of these devices. Mr. Cole obtained a prize of 100*l.* from the Treasury for an essay on the best method of carrying out some parts of the reform, and ultimately he was taken from the Records Office to assist in remodelling the postal system.

His next dealings were with railway administration, and he took part in the "battle of the gauges," but this work was, we should think, somewhat out of his line. It is dull and heavy reading after the fun and energy shown over postal reform. At length he emerges from dealings with railways and docks into the more pleasant paths of art. Under the *nom de plume* of Felix Summerly he produced handbooks on art. In this connection he threw himself into wood-engraving, and so "mastered the technicalities of etching on copper that my works obtained admission (vol. i. p. 103) to the Royal Academy." In Summerly's handbooks, also, essays in bookbinding were made, and the beautiful designs of Holbein, as well as the fifteenth century patterns for leather still remaining in Durham Cathedral, gave suggestions which were used. The Summerly tea-service, which won a prize offered by the Society of Arts, is still much admired. An engraving is given in vol. ii. p. 178. Out of his work under this head sprang his connection with the Board of Trade and their School of Design.

Henry Cole as Felix Summerly strove to "make art common"—a reproach he would have accepted joyfully. Assisted by the best art of his day, he produced artistic books for children, prepared descriptive catalogues of the art treasures of the country, and endeavoured to realise Gibson's ideal panel, in which is represented the marriage of Art and Commerce. His next move in this direction was to persuade the Society of Arts to get up a national exhibition of British manufactures. Prince Albert was the active President of this Society. It was he who developed the idea into a universal exhibition—the Great Exhibition of 1851. At this part the notes are particularly full. It is as if Henry Cole had never done anything remarkable before or since. If this gigantic undertaking was a gigantic success, the credit is largely due to the energy and ability of Henry Cole, who was rewarded with the decoration of C.B.

The work of the Great Exhibition and the other exhibitions which followed interfered for a while with the development of the two greatest undertakings of this busy creative life. We refer to the South Kensington Museum and the Science and Art Department. The Museum stands by general admission first of such institutions. Here the designer and the artisan may study a vast collection of the products of human ingenuity. The idea seems to have sprung naturally from the Great Exhibition of 1851. If such a show be good for the development of manufacturing and mechanical ingenuity and for creating artistic taste, why not have one in permanence? When the question arose what was to be done with the surplus profits of the Great Exhibition, it occurred to the Prince Consort and the Executive to found a museum for a permanent exhibition. Accordingly, on accepting from the Board of Trade the task of reforming art instruction throughout the land, Cole recommended the purchase of art objects from the Exhibition. The usual objections of red tape stopped the way for a time, but the indefatigable reformer, backed by the Prince Consort and Lord Granville, triumphed as usual, and a Committee was appointed, empowered to spend a sum of 5000*l.* This transaction is the real origin of South Kensington Museum. The collection then purchased (1851) was the nucleus of a museum of art manufactures "which should have its connection through the whole country and help to make the schools of art as practical in their working as those of France and Germany" (vol. i. p. 283). We may here remark that though there is a circulating department at South Kensington Museum it is by no means in a forward state. A few pictures are lent for six weeks at a time to local schools of art, and whenever an exhibition is got up, South Kensington contributes specimens with not too liberal a hand; but Mr. Mundella has promised more, though in indefinite terms. Wherever a local museum is maintained in fair efficiency there should be a division supplied continuously from South Kensington. It is not enough to wait for local action. The department should invite applications and raise public attention by means of a letter (not circular) sent now to this mayor and now to that. The subject would then probably be brought forward in the Town Council and discussion and inquiry would result. This proceeding would be dreadfully unofficial no doubt; but South Kensington, which inherits the traditions of a sagacious chief, is perhaps the most *human* of all government departments. It can stoop to consider ideas from outside. Possibly steps have been already taken in this direction as regards the Liverpools and Birminghams of our land. The writer's experience with much smaller towns has led to the conclusion that *temporary* aid of the kind above indicated is much needed in the interests of art development; *temporary*, for with regard to the Government and local effort, the aim should be to throw the dependency as soon as prudent on its own resources. First the child is nursed and coddled, then he is placed "under tutors and governors," who harden him off, and at last he is left to manage for himself and to pick himself up when he falls. A vigorous son of the north, whose heart was in this work, laid this down as the best policy: "First a stick and then a kick." It is remarkable, indeed, how small a part of the aid given by the Government reaches the institution for which it is intended. For scientific apparatus teachers have again and again gone into the open market and done better than with the Government aid of 50 per cent. through accredited agents. In books we have known a great part of the aid given by the Science and Art Department to be swallowed up by insufficient deduction from the published price and by unusual charges for packing. The supply of art specimens also is faulty in this respect. It is probable that competition would not permanently remove these objections. The Department should in our opinion *give*, and give not needful things but accessories—not the beef but the condiments—and having thus evoked a more cultivated appetite should leave it to seek its own gratification.

Those who wish to know with what painful steps and slow the magnificent collection at South Kensington was got together, will find full particulars in the latter part of the first volume of this interesting memoir. It was started at Marlborough House, beginning with the art specimens which had been collected for the old Schools of Design and the purchases from the Great Exhibition. Subsequently, grants were made by Parliament for purchasing specimens of artistic specimens of all ages, and the never-to-be-baffled Director gave his superiors no peace, and probably would have been equally importunate and equally unsatisfied if he had reached the age of Methusaleh. This worrying may have been very unpleasant for the political heads of the department, but it has been a good thing for the country. Whoever visits South Kensington Museum and profits by his visit should bless the pertinacity of Henry Cole. Not only the Government was waylaid, but the Queen and Prince Albert, and other collectors and possessors of art objects were invited and persuaded to give the public an opportunity of seeing them for a time in the Museum. Loan exhibitions of furniture, &c., were formed, and photographs, casts, and electrotypes were made of the finest objects which thus came temporarily into the possession of the Museum. This system of reproduction has helped to develop immensely certain divisions of the Museum, and is likely to be of immense benefit to museums generally. Witness the splendid electrotype reproductions of Corporation and College plate in South Kensington Museum. Purchases were made from the Bernal Collection and that of M. Soulages was added to the treasures of South Kensington after an intricate series of negotiations. The pictures which the Rev. John Sheepshanks bequeathed to the nation also found a home here, but his desire that they should be on view for the working people on their day of rest has not been respected. The Editors note the condition on which the bequest was made, and dryly add that after the arrival of the collection at South Kensington it was inspected on many successive Sundays by members of the Legislature and their friends, but it was hardly their Sundays in particular that this public benefactor desired to refine and brighten. South Kensington Museum succeeded to Marlborough House in 1857, and it continued under the rule of "King Cole" till 1873, when he retired on full pay, not altogether willingly, we believe. No doubt he was a despot, but in the early stages of unique institutions a despot is necessary. As it stands, South Kensington Museum is a lasting monument of his foresight, his delight in work, and zeal for the material prosperity of his country.

But the Science and Art Department is Sir Henry Cole's greatest work, and the greatest monument of his genius. How he kept on teasing the Government for money and spending more than was allowed, till at last he had put together a noble collection, and the Museum was a fact—this is generally known; but the history of the Science and Art Department has yet to be told. It was conceived and constructed by a dogged inventive genius which knew how to turn difficulties into stepping-stones to success, and to wear out stolid opposition by vivacious pertinacity.

This Department was formed as a branch of the Education Department, with Henry Cole as its head, its hands, and its feet, under the nominal control of the successive Presidents and Vice-Presidents of the Privy Council. These statesmen we will venture to say had little idea of what was being done in their name. The grants which the manager was able from time to time to obtain were utterly insufficient for ordinary lines. We know the old jog-trot idea which a commonplace mind would have formed: First, to train teachers, and then to found and maintain schools in the different towns of the land; but Cole's plan was to bribe teachers to qualify themselves by promising them payments on the results of examinations in various centres supplied with papers from London to be worked out under local committees at a minimum of expense. Soon the land was covered with schools of art and science classes, to the astonishment of the statesmen who supposed that they had been holding the reins. As a result, the English people were converted from Philistinism, and became ardent lovers of art. In the poorest cottages may now be found vessels of artistic design and other delights of the eye, as cheap as the ugly patterns which obtained everywhere except in the houses of the richest a few years ago. In the recent debates in the French Parliament on the proposed renewal of the Commercial Treaty with England, the French Minister stated that when that treaty was first made, in 1859, France supplied England with almost all its objects of art, but that in the interval, owing to the work of the schools of art, the tables had been turned, and it was now England that was pouring these articles into France. It was *ce terrible Cole* who had stuck to his work, undeterred by abuse and opposition, till he had redeemed England from its dependence on the ingenuity of France.

Sir Henry Cole's retirement from office in 1873 did not mean retirement from work. Out of office, he set himself to do for music and cookery and sanitation what he had largely done for art, namely, to make their principles and practice common and popular. He pictured an England whose toilers, admitted to participate in the benefits of civilisation, found relief in refined enjoyments from the depression resulting from the minute division of labour into dreary monotonous tasks, without variety. The part he bore in establishing the Kensington Training School of Cookery and the School of Music, and his share in promoting the Albert Hall, will best show the earnest work of his later years. His work and his life in fact ceased together.

Whoever will read the list of the tasks which Sir Henry Cole set himself, as enumerated at the beginning of this article, will not find it hard to discern running through the whole of this busy aggressive life one constant, continuous idea. Like the great English reformer who vowed that he would make things plain for a ploughman which had been reserved for the understanding of a cultivated few, Henry Cole lived to make the poor sharers in the best benefits of modern civilisation. He set himself to make common those refining agencies which tend to cheer and sweeten the dull monotony of excessive toil and hopeless poverty. Hence his efforts to stimulate the creative faculties of the nation, to make known our art treasures, to cheapen specimens of art and to call out the dormant sense of delight in the beautiful, so as to reach and raise men through their higher faculties of enjoyment. He who sets himself to "level up" and to destroy privileges by making them common will have enemies enough in his time. Probably Sir Henry Cole had his full share of abuse and misrepresentation. But, unlike many of the world's benefactors, he lived to see much good fruit resulting from his pertinacious toil for the public good, and he will not soon be forgotten by a grateful country.

NEWTON PRICE

EARTHQUAKES AND FIRE-DAMP

On the Observation of Earth-shakes or Tremors in Order to Foretell the Issue of Sudden Outbursts of Firedamp. By M. Walton Brown. Excerpt Minutes of Proceedings of the North of England Institute of Mining and Mechanical Engineers, vol. xxiii. 1884.

A Theory of Mine Ventilation. By M. Walton Brown. (Printed by Lambert and Co., Limited, 50, Grey Street, Newcastle-on-Tyne, 1884.)

THE first of Mr. Brown's two papers contains a proposal to institute the systematic observation of earth-tremors for purposes which he describes as follows:—

"Whatever may be the cause of the issue of sudden outbursts of firedamp the quantity of gas produced is extremely variable and irregular. Many theories have been from time to time advanced with the object of defining the laws which govern these sudden outbursts of gas from coal and adjacent strata.

"It would appear that there is some connection between sudden outbursts of gas and the motions to which the crust of the earth is subject: in other words, that slight motions of the earth's crust may be followed by more or less violent outbursts of gas. Thus, if there were a large body of gas pent up in a subterranean reservoir, and some movement of the earth's crust took place forming fissures of varying depth and width, affording channels for the escape of this gas, upon such a fissure being reached in the workings of the mine, a blower would be the result, the volume and duration of which would depend upon the volume of the reservoir, pressure of the gas, and width of the fissure. If this theory is the true solution of the problem, it follows that the systematic and regular observation of earth movements would eventually prove a reliable means to some extent of foretelling when outbursts of gas should be anticipated."

If gas existed in subterranean reservoirs such as those imagined by Mr. Brown, then, undoubtedly, when the workings of a mine reached a fissure communicating with such a reservoir all that Mr. Brown anticipates would happen. Supposing it possible, however, that a fissure could be formed by an earth-tremor at the depths at which firedamp exists in a sufficient state of tension to give rise to an outburst when tapped, it does not by any means follow that the observation of earth movements could assist us in foretelling when such outbursts would be likely to happen. For the position of any given fissure, relatively to that of the workings, must obviously be an unknown quantity, so that, for anything we could know to the contrary, the fissure might either be broached on the day of its formation or not for many years afterwards.

This paper is illustrated by two plates: one, a seismographic map of Western Europe, showing the distribution of earthquakes, copied from the map prepared by the Messrs. Mallet; the other a diagram showing, by curves, the relative frequency of earthquakes and fatal explosions of firedamp, and the mean height of the barometer monthly from January of one year to April of the following year. The explanation of the second plate appears to be incomplete. As regards the barometric curve, we consider this a good opportunity of remarking that all attempts to correlate mean barometrical observations extending over longer periods than a few hours with explosions in mines appears to us to be labour lost, and similarly we are satisfied that the bald statement so often met with, that the barometer was rising or falling at the moment any particular explosion happened, is devoid of value, and leads simply to confusion. This subject was most carefully investigated by Mr. R. H. Scott, F.R.S., and the writer some years ago, and the results were published in various papers at the time (*Proc. Roy. Soc.*, 1872; *Quart. Journ. Met. Soc.*, 1873 and 1874). The diagrams which accompany these papers show very distinctly that the barometric curve ought to be known accurately for several days before the occurrence of an explosion if it is desired to form a true opinion as to the probable influence of atmospheric agencies in the case.

In his second paper Mr. Brown does good service by calling the attention of the English reader to the manner in which the problem of ventilating mines has been simplified by the recent researches of M. Murgue, the able director of the Bessèges Collieries in France. M. Murgue's articles were contributed to the *Bulletin de la Société de l'Industrie Minérale*, second series, vols. ii., iv., and ix.; and his views are also very clearly set forth in the second volume of M. Haton de la Goupillières's excellent and concise "Cours d'Exploitation des Mines," just published.

It is evident from the nature of the case that the details of no two mines can be exactly alike as regards the resistances which they oppose to the circulation of ventilating currents through them. The diameter and depths of the shafts, the lengths, areas, bends, ascents, and descents, and comparative roughness of the sides, of the air-ways, the temperature, tension of water vapour, and the velocity of the air-currents, must all vary with every varying circumstance. Accordingly, any attempt to compare the total resistance of one mine with that of another by finding the value of each element in the calculation and summing up the results could produce nothing but complication and disappointment.

M. Murgue has solved the problem by referring the sum total of all the resistances to one single and very simple resistance, namely, that of an orifice in a thin plate, which he calls the *equivalent orifice*. He describes it as *the area in square metres of the orifice through which the same manometrical depression will cause the same volume of air to pass in the same time as in the mine.* This area is found as follows:—Let a be the area required, q the quantity of air, v its velocity in passing through the orifice, and 0·65 as the value of *vena contracta*. Then—

$$q = 0{\cdot}65\, a v.$$

Taking w the specific gravity of the air (estimated by M. Murgue at 1·2 kilo. per cubic metre), and h the manometrical depression (expressed in kilograms per square metre, or, what is the same thing, in millimetres of water), we have:

$$h = w \frac{v^2}{2g}, \text{ or } v = \sqrt{2g\frac{h}{w}},$$

whence

$$q = 0{\cdot}65\, a \sqrt{2g\frac{h}{w}}.$$

Then by introducing the numerical values of w as given above, and of g as 9·8088 metres, we get—

$$q = 2\cdot63 a \sqrt{h},$$

whence

$$a = 0\cdot38 \sqrt{h}.$$

But we can always ascertain by observation the values of q and h in any given case, so that the value of the equivalent orifice can be easily found.

M. Murgue has determined this value for a large number of mines and has given the results in tables in his second article, already referred to. The values vary somewhat above and below a square metre, but a large number of them are very little different from that unique area. The author calls those mines whose equivalent orifice is greater than a square metre, *wide*, or roomy, and those in which it is less than a square metre, *narrow*, or confined.

M. Murgue has applied the same mode of comparison to the resistances which the air has to overcome in passing through the various kinds of ventilating machines, and in this case he distinguishes the corresponding orifice by the name of *orifice of passage*. The manner in which its value is found is similar to that of the equivalent orifice.

In Mr. Brown's paper will be found a table containing a summary of experiments made, with six different kinds of ventilators, by a Committee of the Société de l'Industrie Minérale, in which the translator has reduced the French measures to their English equivalents. He also gives two diagrams: one showing the volumes of air produced by the same ventilators kept running at a uniform velocity, while the equivalent orifice is gradually increased; the other showing the curves of useful effect for four of them. On the whole, we consider that the contents of this paper deserve the careful consideration of those who have not an opportunity of consulting the original articles.

W. GALLOWAY

MAGNETO- AND DYNAMO-ELECTRIC MACHINES

Magneto- and Dynamo-Electric Machines. From the German of Glaser de Cew, by F. Krohn. Specially Edited, with many Additions, by Paget Higgs, LL.D., D.Sc. (London: Symons and Co., 1884.)

THIS book is issued as Volume I. of "The Specialists' Series," to be edited by "Dr." Paget Higgs and "Professor" Charles Forbes. From what University Mr. Higgs holds his degree of Doctor of Science does not appear. Presumably, he is the same person as the "Rev. William Higgs, M.A., D.D.," who formerly edited an electrical periodical in London, and afterwards left his country. Readers of the admirable volume on the "Transits of Venus" in the *Nature Series* know the name of Prof. George Forbes, and appreciate his scientific standing. They are not likely to confound him with the Mr. Charles Forbes who appears as joint editor.

The present volume, translated and "specially edited," gives to the public little that it did not previously possess. Of books on electric lighting there are enough and to spare. Dr. Schellen's work on "Magneto- and Dynamo-Electric Machines"—an excellent translation of which is now appearing in New York—was the first good work of the kind, and it has run to a second edition. In title and in matter it is greatly resembled by the present work; but Schellen's work is far more elaborate and complete; whilst the one merit of the Glaser-de-Cew-Krohn-Higgs-Forbes volume is that it includes a brief chapter on accumulators—too brief, considering that the various types are well and concisely explained. For the rest, the additions are chiefly scissors and paste work. Chapter VII., on Constructional Laws, is largely taken from Prof. S. Thompson's "Cantor Lectures"; Chapter VIII. gives the old set of tests executed for Trinity House in 1877 on obsolete types of machine; the only addition, relating to the later and far more perfect tests made at Paris in 1881, Munich and Crystal Palace (London) in 1882, and Vienna in 1883, being an editorial footnote five lines in length. Chapter X. is extracted from Du Moncel's book on "Electromagnets"; Chapter XI. (on Instruments for Measurement) is apparently amplified from the price list of a certain firm of electrical engineers, whose instruments, exclusively, are described. Chapter XIII. is an abridgment of Clausius' theory of the dynamo-machine, reprinted *verbatim* from the abstracts from foreign journals in the *Proceedings* of the Institution of Civil Engineers. The index is most elaborate: it occupies nearly a twelfth of the whole book. There are several glaring errors in the work. Of these is the statement, on p. 100, that in a compound-wound dynamo—in which it is desired to provide a current varying exactly proportionally to the number of lamps that are connected to the mains—there must be maintained "a constant magnetic intensity." On p. 143 it is elaborately set forth that the ratio of the part of the effective electrical energy which is converted into real work to the total electric energy of the current can "never be greater than ½"; and on p. 147, equally elaborately, that "the maximum efficiency of an electro-generator is obtained when its internal resistance is equal to the resistance in the external circuit." If the latter statement were true the maximum efficiency could never exceed ½. The fact is that both statements are untrue and misleading, as are several of the statements relating to efficiency on p. 144. Apparently, either the translator or the editor does not understand either the English meaning of the German word *Nutzeffekt*, or the technical meaning of the English word *efficiency*. On p. 173 the shifting of the neutral point in the rotating armature is referred to the alleged fact (?) that "the magnetism of the iron core and the current in these turns of wire (which have passed the poles) remain at the same intensity for a few moments." The statement is misleading, and the supposed explanation of the shifting of the neutral point is well known to be a fallacy. Still more extraordinary is the statement made, apparently with scientific seriousness, on p. 174, that the heating of the iron core of the armature is another "consequence of the fact that the maximum magnetism does not immediately disappear." There are several mistakes in the definitions of the electrical units as given in the last page of the preface. The *watt* is given as the unit of *work*, instead of the unit of activity; and the extraordinary statement is made that the untit of potential difference "exists between two points when the unit quantity of electricity, in moving from the one point to the other, *requires a unit force* to overcome the electrical repulsion," thus making the definition of potential depend on *force* instead of *work*. Moreover, the static units are called the "C.G.S." units without any mention of the magnetic units of the C.G.S system, leading the reader to conclude that the *volt* is equal to 10^8 of the static C.G.S. units. These are grave errors in a book designed for specialists. On p. 94 the author, or editor, announces the insertion of some "data given . . . *by physicists known for their veracity.*" Are there any others?

OUR BOOK SHELF

Key to Magnus's Class-Book of Hydrostatics and Pneumatics. (London Science Class-Books.) By John Murphy. 67 pp. (London: Longmans, Green, and Co., 1885.)

MR. MURPHY has rendered useful service to science teachers by the publication of the solutions of the exercises and problems given in Mr. Magnus's widely-known volume. These problems cover the whole ground of elementary hydrostatics and pneumatics; and the solutions are intelligently worked out in full. The work has had the benefit of Mr. Magnus's own revision; and this should be a guarantee of the goodness of the methods followed and of the correctness of the results. The only fault we have to notice is a tendency to looseness in the use of certain terms about which there ought not in physical science to be the slightest vagueness: we refer to the misuse of the words *strain* and *pressure* where the proper word should be *force*. A strain is an alteration of shape or volume, and ought not to be confused with the force which produces the strain. A pressure is a force divided by an area and cannot be specified except by naming both the force and the area on which that force acts. Yet on p. 5 of Mr. Murphy's Key occurs the statement that "the pressure or whole strain to which the sphere is subjected equals the weight . . . of the liquid." It is greatly to be desired that this ambiguity between pressure and force should as speedily as possible be removed from this and all other elementary books, as it is misleading to beginners as well as incorrect.

Electrical Units. By Dr. R. Wormell, M.A. (London: T. Murby, *no date.*)

THIS little work of 48 pp. is apparently issued as an appendix to the author's class-book of "Electricity and Magnetism." It contains a concise and easy account of the units in ordinary use, and of the notion of dimensions of units so puzzling to beginners. A number of useful data of constants are given, and there are some numerical problems for calculation added. Dr. Wormell's genius as a teacher comes out in several points: the transition from magnetic to electro-magnetic units being particularly neatly brought about on p. 10. A few slips should be corrected at once. In the table on p. 1 the electro-chemical equivalent of hydrogen is given as ·00001055, and on p. 14 as ·0000105. According to the late results of Kohlrausch and Lord Rayleigh it is ·00001035. On p. 6 the horse-power is wrongly stated as 746 kilogramme-metres per second. On p. 15 there is a curious muddle about units of capacity, arising partly from a confusion between electrostatic and electromagnetic units. It is certainly *not* true that a sphere of one centimetre radius has a capacity about equal to that of "the whole Atlantic cable"; neither is the *farad* the millionth part of the *microfarad.* It also must strike the practical electrician as rather a curious statement that (p. 33) the Swan lamp is usually fed by the Gordon dynamo. We were under the impression that only one Gordon dynamo had yet been built, and that it had not been used since last winter. The connections of the Brush armature on p. 37 are wrong; and the author should not describe Edison's armature as being like that of Gramme, when the fact is that it pays royalty to Siemens as a Siemens armature.

Weekly Problem Papers, with Notes, intended for the Use of Students Preparing for Mathematical Scholarships and for the Junior Members of the Universities who are reading for Mathematical Honours. By the Rev. J. J. Milne, M.A. (London: Macmillan, 1885.)

MR. WALTER BESANT in a recent work entitled "In Luck at Last," makes his heroine (a Maria d'Agnesi or a Somerville) remark, "No life can be dull when one is thinking about mathematics all day. Do you study mathematics?" For such a one this handy volume of a hundred papers, each of which has at least seven questions, some of which bifurcate or trifurcate, will be a charming companion. Though the range is limited to the requirements of a University scholarship—this by the way is fairly extended at the present day—yet there is sufficient "variety" in the selection of problems to make it what we state it to be above, "charming." The book, as such a work ought to be, has been printed with very great care, and, after a close perusal, we have detected only two or three slight clerical errors. The compiler, who is to be congratulated on his successful achievement of a somewhat difficult task, proposes to bring out at a future date a second volume containing his solutions to the exercises. Wolstenholme's collection is, except under the guidance of a judicious tutor, too hard and too full of tricks for the class whose wants this manual is designed to meet; the boy who has mastered this collection, or a fraction of it, will have realised what sort of questions he will be called upon to "tackle" when he has an examination paper before him.

LETTERS TO THE EDITOR

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

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

Free Hydrogen in Comets

TOWARDS the end of an admirable mathematical paper on the theory of the forms of comets, received this morning by post from M. Bredichin, that very able Director of the Imperial Observatory of Moscow (specifying himself, too, in English at the head of a pamphlet in the French language as "Associate of the Royal Astronomical Society"), draws the conclusion that the great comet of 1881 was a structure of compound hydrocarbon gas, while Halley's historic comet was "of a type which corresponds to pure hydrogen."

The distinguished author's position with regard to the comet of 1881 I presume will be contested by no one; for all the spectroscopes of the time proved so abundantly that the light of that comet was of the kind familiarly known among technists as "the candle-spectrum," or the spectrum of the compound gas CH, in the form of acetylene, perhaps, but entirely peculiar to carbo-hydrogen. Who, however, can help the theorist of Moskva's white-stoned city and golden domes to establish the probabilty of a spectrum of pure and elemental hydrogen gas for Halley's comet, before that wanderer in far off space shall return in the beginning of next century, and then instantly testify its chemical composition to the spectrum analysis of that day?

One of the difficulties which M. Bredichin has to deal with meanwhile, seems to be, that no trace of a pure hydrogen spectrum has ever yet been seen in any comet, however much of CH there may have been; and he is driven to suggest that the H, or hydrogen lines—so entirely different from those of CH—were invisible on account of their faintness. But though that idea, with some modification or explanation, may ultimately turn out to be correct, it requires something more just now to create many converts to it, particularly in face of the universal experience of all dabblers in spectroscopy with vacuum tubes; for they know so well that, whatever the reputed gas in them may be, intrusive lines of hydrogen, though present as an unavoidable impurity only, are usually the most incisive and brilliant part of the display.

In a paper, however, on "Micrometrical Measures of Gaseous Spectra," kindly printed, but not yet published, for me by the Royal Society, Edinburgh, there is a full description of a case which will be found to supply exactly the practical details that may strengthen M. Bredichin's views.

After having had tubes, and tubes, and tubes again of CH gas, of various varieties of CH and at various pressures made by different makers, and having found their CH spectrum (under the electrical incandescence which M. Bredichin also assumes for his comets) always more or less imperfect and more and more haunted, often overpowered, by the brilliant lines of pure hydrogen, I followed out the indications of least failure by eventually having made a so-called vacuum, but really four inches of mercury pressure tube of olefiant gas. It was constructed for me, with very peculiar attention to, and precautions for, purity, by Mr. Charles F. Casella, of 147, Holborn, and attained absolute success at last, for no trace of any impurity whatever could I discover in it from one end of the spectrum to the other.

Not only so, too, but the spectrum which it did show was the most brilliant and perfect one of CH that I have ever heard of. Every one knows the five diversely coloured bands of CH, four of them first well described by Prof. Swan in 1856; each band beginning towards the red with strong lines and bright haze, which fades off towards the violet side into black, vacant space long before the next band begins. And many persons know that with greater spectroscopic power that haze is capable of being resolved into a system of smaller lines, and far closer, or linelets, but still coming to an end considerably short of where the next band begins.

But on this occasion, with the extra heavy olefiant gas-tube, strong induction sparks, and a spectroscope having 24° dispersion from A to H of solar spectrum, a telescopic magnifying power of 14, a very narrow slit and excellent definition of prisms, the linelets, usually so difficult to identify, were as sharp and clear as luminous needles, and continued, in a series of regularly-increasing spaces apart, the whole distance from one CH band to the next. This completeness was distinctly proved, first with the Orange band and its needle-like scale of linelets (after all its strong lines had been left behind), extending up so as to touch, as it were, the brilliant beginning of the Citron band. Then came *its* bright lines and closely-packed linelets continually widening in distance apart, but losing nothing in sharpness and definition until the Green band was reached. With the Green band was its leader (the so-called "Green Giant of Carbo-hydrogen") burning like a pillar of electric fire; then its close linelets; then its second line and linelets rather wider apart; its third line and linelets still wider; and onwards linelets wider yet, but preserving admirable regularity of series all the way, all the long way, without missing, or slurring, one step, the whole distance right up to the beginning of the Blue band.

Yet over one part of that lengthy road something extraneous did appear; vaguely at first, or as a mere faint ghost of a barely perceptible roll of gray-coloured cirrostratus cloud! Could it be subjective only? possibly the reflection from a fatigued part of the retina of the observer's eye. Not that, for the linelets of CH were still brilliantly sharp, thin, and narrow everywhere. What then? I, who had condemned scores of vacuum tubes of all the gases for being filled with H lines, had never seen anything like that floating, filmy cloud before!

But thought is quicker than sight. A suspicion of the truth flashed in a moment upon me; and on turning to the Red end of the Spectrum, there, over the known place of Hydrogen's Red line, was another faint broad region of barely visible luminous haze, but reddish, in place of, like the other, a blue-gray. Even, too, as I watched them, from that moment on through an hour, first turning to one and then to the other, those haze-clouds narrowed and narrowed towards their central verticals, whilst the sharp little linelets of the CH *pari passu* became paler and paler, until at last they only remained visible in the neighbourhood of the bigger lines and strong beginnings of their respective bands. And by that time the once faint clouds, the red and the gray, had become transformed into two piercingly bright lines of Hydrogen light, the representatives of Solar C and Solar F; while the carbon of the CH, which the H had been eliminated from by the action of the electric spark, was deposited on the inside of the tube as a brown glaze.

This, then, is the case of independent observation which I beg to hand over to M. Bredichin for discussion, believing it to illustrate that

(1) In the condition most suitable for showing the CH, or ordinary cometic, spectrum,—no H should appear.

(2) If a little free H should be introduced into a full atmosphere of CH, the characteristic lines of H are at first so *extra* broadened—though seen under the same circumstances that those of CH are *ultra* narrow and defined in—as to be weakened thereby below visibility, unless, indeed, the CH spectrum at the time be almost infinitely brighter than it has ever yet been found in any Comet.

(3) The longer the incandescing electric influence is at work, the greater is the evolution of pure H on one side, and deposition of solid C on the other, out of CH gas. Whence we may possess for the future an indicator for the comparative age of Comets; or, at least, may pretty certainly conclude Halley's Comet to be older than that of 1881, if bright, narrow lines of pure H, with or without CH bands accompanying, shall be visible in the spectrum of the former at its next return: that, in itself a consummation long most earnestly wished for, but now more than ever to be desired, to test the penetrating theory of a Russian Astronomer and Mathematician.

C. PIAZZI SMYTH

15, Royal Terrace, Edinburgh, January 19

Iridescent Clouds

ON pp. 148 and 149 of the current volume of NATURE there are two letters describing "iridescent clouds," and the idea is conveyed that this phenomenon is only of late occurrence. That this is hardly justifiable, the following account from a diary will show:—

At Knoxville, Tennessee, on the afternoon of February 16, 1878, after many days of cloud and drizzle—something unusual in that country—the sun being about 10° high and the sky partially covered with large haze-clouds, there was noticed in the south-west, against one of these clouds, a slightly curved band of prismatic colours about 90° in length; which, but for its position in the west, might have been mistaken for a rainbow—concave toward the sun, the sun, however, not at the centre of curvature, and about 30° distant from it. The green was most strongly marked; this shaded off on each side, and on the side of the band next the sun was red; upon the opposite side the colour was less distinct, but there it seemed to be reddish.

Again, during September or October 1882 (this from memory), at the same place, about sunset, with a patched, cloudy sky, the sun not visible, the prismatic colours were noticed in the south-west near a break in the clouds. This time the colours were in the form of an elongated ellipse, with indistinct edges, between 2° and 3° in greatest length.

Then, during the fall of 1883, the prismatic colours were once noticed under similar circumstances to those mentioned here in Virginia.

W. G. BROWN

University of Virginia, Virginia, U.S.A., January 12

The Iridescent Clouds alluded to above

In our northern as well as insular position, with weakened sunshine and an atmosphere always more or less darkened by coal-smoke, we must be prepared to allow much for what is, and is to be, seen of the grander meteors of meteorology in the more southern latitude, clearer air, and intensified climate of the Virginian portion of so great a continent as America. But before any one there can claim to see frequently that very phenomenon of the iridescent clouds, communicated last December to NATURE by various persons, but by myself perhaps as the chief culprit, he must be quite sure, amid the crowd of known and already described parhelia, mock suns, broken rainbows, &c., that what he sees has the same discriminating optical characteristics as those particular clouds now in question; and that any one of his cases was, in America, so unusually brilliant a display of them, and so widespread an instance of it, that from one end of the States to the other it was on the same day similarly seen, wondered at, and declared even by gray-headed old men to be new to them, in at least anything approaching that astonishing degree of splendour and perfection, though by no means new to creation over a longer lapse of time.

The Virginian letter-writer, however, speaks merely of what he himself saw, describes the colours as prismatic, in place of the anti prismatic arrangement witnessed here, and alludes to one case of a curved band "about 90° in length," which contrasts exceedingly with the forms and sizes noted in this country.

In fact I can hardly give a stronger confirmation of the rarity, and both the general character and universality of the phenomenon on that occasion, for all parts of Great Britain than by concluding with the following extract from a letter by Prof. A. S. Herschel of Newcastle-on-Tyne, dated December 25:—

"I saw," he writes "(and photographed from a window, but lost by over-exposing the plate, unfortunately), the iridescent clouds of Thursday's sunset you describe in NATURE, and nothing more beautiful than the diamond-beetle *elytra*, or Papilio-pario wing-scales, which glittered in the western sky could, as you wrote, be possibly *imagined!* They were seen also in the south of England (Kent) between 2 and 3 o'clock on the same afternoon.

"Mr. N. here says, in resumption of what they were probably, that he often sees such coloured fringes and colour-bows, in circles too, on clouds near and round the sun, by looking at the sun's reflection and that of the clouds just round him, in the plate-glass window of his drawing-room.

"So no doubt it was a good instance only of a common sight, but an instance yet, I should say, not to be seen much oftener than once or twice in a century!"

To that opinion I do not presume to add one word.

C. PIAZZI SMYTH

15, Royal Terrace, Edinburgh, January 28

Manx Cats

WITH reference to Mr. Francis Galton's remarks in NATURE on Manx cats, I should like to ask whether any of your readers can assist me. Some little time ago I imported a few Manx cats with a view of trying experiments with them in crossing. But, as Mr. Galton says, it is difficult to get cats to breed in confinement, and of course it is of no use for the purpose of my experiment to allow the animals to roam at large among ordinary cats. Acting upon Mr. Galton's suggestion, therefore, I write to ask whether any of your readers happen to know of any island within a reasonable distance from town where a breed of Manx cats could be established. It is not necessary that the island should be a marine one. Any piece of ground insulated by fresh water would do equally well, provided it were of moderate size and not already tenanted by cats. If any of your readers should know of such a place I should be greatly obliged to them for a reference to its locality.

I may take this opportunity of further inquiring whether any of your readers would care to lend me, or tell me where to procure, a really good talking parrot for the purposes of systematic observation.

GEORGE J. ROMANES

Cross-breeding Potatoes

IT is well that your correspondent, Mr. James Melvin, has called attention to the dubious and erroneous ideas which now largely prevail on this subject. There is no reason to suppose that hybrids arising from *Solanum Maglia* will be disease-proof, for *S. Maglia*, like *S. tuberosum*, is one of the known hosts of the potato fungus, *Peronospora infestans*.

The errors appear to have arisen from the unfortunate conclusions,—"Economic Suggestions," given by Mr. J. G. Baker in his otherwise admirable paper laid before the Linnean Society, April 1884, p. 505.

Mr. Baker thinks that, because *S. Maglia* comes from humid positions in America, it will succeed in Britain better than *S. tuberosum*, a plant of the dry hills. The correctness of this idea I should very much question, the great strongholds of fungi being humid places. The fact of the habitat is an important one, but the deduction made from it is questionable.

Mr. Baker says the potato plant in its present tuber-bearing state is in a "disorganised and unhealthy condition." This view also is very much open to question: there is no evidence of disorganisation and unhealthiness in cultivated potatoes. Cultivated potato plants are no more disorganised and unhealthy than are any of our other cultivated kitchen garden plants, fruits, flowers, or domestic animals, including man himself. The notion that disorganised and unhealthy plants are "fitting subjects for the attacks of fungi and aphides" is a mistake, for fungi (*i.e.* parasitic fungi,—the fungi Mr. Baker has in view) do not grow upon "disorganised and unhealthy plants;" they require healthy plants on which to grow. Of course vegetable parasites require for their sustenance the vigorous elaborated juices of healthy plants, not the vitiated juices of "disorganised and unhealthy" ones.

Leaving theory for fact, I may point out that in the published results of experiments made by Dr. Hogg last autumn, both *S. Maglia* and *S. Jamesii* were badly diseased with parasitic fungi, and in Mr. Thomas Laxton's published experiments nearly the whole of the plants of *S. Maglia* and *S. Commersoni* (the two species specially recommended by Mr. Baker), as well as *S. Jamesii*, "disappeared from disease."

A year or two ago Mr. John King, British Vice-Consul, Carrizal, Bajo, Chili, sent to this country twenty stones of potatoes from positions in Chili where, during an experience of more than twenty years, the disease of potatoes had never been seen. It was perfectly unknown to the growers there.

These twenty stones of potatoes were planted in different parts of Great Britain and were a failure. They fell before *Peronospora infestans* quite as readily as did our own common potatoes.

No doubt good will arise from the experiments now being carried out, but not in the way generally assumed. The only theme for regret is the publication at the outset of (as I think) curiously mistaken deductions. These deductions, coming from such an excellent botanist as Mr. Baker, have led potato growers very much astray.

WORTHINGTON G. SMITH

Earthquake

THE annexed copy extracts from letter dated Kingston, Jamaica, January 8, from Capt. Spray, of our s.s. *Maroon*, will no doubt interest you. Are we right in thinking that the shock he felt was probably connected with the Spanish earthquakes?

J. G. S. ANDERSON

5, Fenchurch Avenue, London, E.C., January 27

Extract of Letter from Capt. Spray

Kingston, January 8

On the morning of December 22, 1884, in lat. 36° 48′, long. 19° 25′ W., we felt a shock as if the ship was grinding over a reef, although there was no difference in speed of engines; stopped and made every examination, but found no cause. My opinion it was a shock of earthquake, as some years before, nearly in the same place, I felt one more severe than the last.

An Instance of "Protective Resemblance"

IN Mr. Johnston's interesting account of the ascent of Mount Kilimanjaro, in Equatorial Africa, which appears from time to time in the *Daily Telegraph*, occurs a passage which seems deserving of being rescued from the comparative oblivion of the pages of a daily newspaper. It will be found in the number of the 16th inst., and is as follows:—"Other noticeable features in the scene were the tall red ant-hills and, strange imitation, the tall red antelopes, a species of hartebeest, resembling faintly in shape the form of a giraffe with sloping hind-quarters, high shoulders, and long neck. Being a deep red-brown in colour, and standing one by one stock-still at the approach of the caravan, they deceived even the sharp eyes of my men, and again and again a hartebeest would start up at twenty yards distance and gallop off, while I was patiently stalking an ant-hill, and crawling on my stomach through thorns and aloes, only to find the supposed antelope an irregular mass of red clay."

New University Club, January 20 J. C. G.

Hibernation

WILL you allow me to invite attention of anthropologists and zoologists to the very remarkable (and to me surprising) statement contained in the article "Hibernation" (W. F. Kirby), last edition of the "Encyclopædia Britannica." Reference is there made to a work by Mr. Baird, entitled "Human Hybernation" (1850), giving examples on "unimpeachable authority" of the powers of religious ascetics in India of throwing themselves into a state closely resembling hibernation for an indefinite period; and quoting a case of a Fakir who was actually buried alive at Lahore in 1837 in presence of Runjeet Sing and Sir Charles Wade, and was dug up and restored to consciousness several months afterwards! Now, it is ascertained that hares can exist for weeks together buried in the snow, and if this power of hibernation can be developed at will, might it not also be so on necessity, and explain the former existence of the Siberian mammoths, through the winter months: these animals might, as winter approached, have withdrawn to sheltered hollows, where they were eventually snowed up and covered with snow. This possibility may have before been started, but seems to me to be reasonable and probable. K. BUSK

Athenæum, February 2

Our Future Clocks and Watches

IF clocks are to strike at all, surely once per hour is insufficient, while four times is excessive; the high hour-numbers even now are inconvenient to count, and with the quarters heard alone it is possible to make a mistake of an hour. I cannot but think, then, on the whole, that the necessities of ship-life have long driven mariners into the very best method, free from all difficulties, and that, whatever our way of noting hours, we could do no better than adopt the naval half-hour strikings for land-clocks, recommencing with each four-hour watch. Some confusion with the existing ways, as long as they survive, is inevitable, and equal whatever change is made.

A mistake of four hours is just as unlikely as one of twelve. We should probably soon find names for the different four-hour divisions; for example, we might denote each half-hour by some letter or cypher. EDWARD L. GARBETT

THE LIFE-HISTORY OF THE LYCOPODIACEÆ

THE area within which really notable discoveries are possible—at any rate amongst the higher plants—in the field of vegetable morphology is becoming very circumscribed. For some time the complete life-history of the *Lycopodiaceæ* has been a missing chapter in our text-books. Hofmeister, like others, had unsuccessfully sown the spores, and he could only speculate as to the probability of their producing—if the proper conditions could be known—a prothallium like ferns. And Spring, the monographer of the group, had hazarded the extraordinary theory that the existing representatives of the group were only represented by male plants, the females having been lost in some remote geological catastrophe.

De Bary made in this, as in so many other fields, the first real advance. He described in 1858 the early stages of the germination of the spores of *Lycopodium inundatum*. But just as Hofmeister had failed to get the spores to germinate at all, so De Bary failed to get the development of the prothallium to advance beyond a very early stage. Thus matters stood till 1872, when Fankhauser had the good fortune to find, in a botanical excursion, young plants of *Lycopodium annotinum*, still united to their parent prothallium.

For my own part, I have always felt that it might be the chance of any wide-awake observer to turn the next unread page in this curiously reserved history. And I have never failed to remind the younger botanists who have consulted me as to a promising direction for work that this was a possibility they should never lose sight of. Within the last few days, however, two fresh contributions to the subject have come into my hands.

The first number of the *Botanisches Centralblatt* for this year contains a paper by Bruchmann, who has, if I mistake not, already done some good work in the vegetative morphology of Lycopodium. He has had the good luck to repeat Fankhauser's happy find, and to have come across, at the end of August last, living prothallia of the same species.

But the paper [1] which will mark its epoch in the history of Lycopodium is that for a separate copy of which I am indebted to my friend, Dr. Treub, the accomplished director of the renowned Botanic Garden at Buitenzorg in Java. Six years ago, when he had no thought that he would ever be able to prosecute botanical research in the tropics, he also made, as so many others have done, unsuccessful attempts to obtain the development of Lycopodium spores. On his arrival at Buitenzorg, he lost no time in endeavouring to find the prothallia of tropical species. He seems to have all but succeeded in discovering those of *Lycopodium cernuum*—but for an accidental circumstance which threw him off the scent—in the first year of his residence there. Subsequently, he sowed the spores on the trunks of trees, and after a delay which led him to abandon any hope of success, he obtained satisfactory results from one of the sowings. Now he is acquainted with the prothallia of three species of Lycopodium, and hopes to be able to describe even a fourth.

In the present paper, which is illustrated with nine admirable plates, Dr. Treub gives an exhaustive account of the prothallium of *Lycopodium cernuum*. It is curious to observe, however, that in artificial cultures he did not succeed in carrying the development further than De Bary had done some time ago with *L. inundatum*. Fortunately, prothallia which he discovered under spontaneous conditions of development exactly fitted in where the others stopped.

The adult prothallium is a very singular structure, consisting of a sort of short cylindrical axis, half immersed in the soil at one end, where it is furnished with root-hairs. The upper extremity bears a tuft of small leaf-like lobes. The archegonia and antheridia are found on the upper part of the cylindrical axis, forming a kind of ring or crown near the tuft of lobes. The prothallium therefore presents a type morphologically more differentiated than is met with elsewhere amongst the vascular cryptogams. While this is the case with the sexual generation (oophore), the spore-bearing generation (sporophore) in its embryonic stage is less differentiated than is the case, for example, in the fern. The embryonic root is suppressed, and the whole embryo, which is wholly parenchymatous, approximates in its morphological characters to those of the prothallium.

W. T. THISELTON DYER

[1] *Ann. du Jardin Botanique de Buitenzorg*, vol. iv. pp. 107-138, tt. ix.-xvii.

JOHN GWYN JEFFREYS

IT is with much regret we have to announce the death of this veteran conchologist. Dr. Gwyn Jeffreys, who was in his usual health the day before, and in the evening attended at the lecture given by his son-in-law, Prof. Moseley, at the Royal Institution, was seized on Saturday morning, January 24, with a fit of apoplexy, and at five o'clock on the same afternoon passed peacefully away. He was the last, or almost the last, of a band of marine zoologists of a former generation who had been his friends. Dilwyn, Cocks, and Couch; Fleming, Gray, Forbes, Alder, and Albany Hancock; Johnston and William Thompson; Barlee and Waller are names of the past.

Dr. Gwyn Jeffreys was born at Swansea on January 18, 1809, and had thus just completed his seventy-sixth year. While a boy he showed a taste for natural history, collecting the insects and shells of South Wales. When only nineteen he contributed a paper to the Linnean Transactions, "*A Synopsis of the Pneumonobranchous Mollusca of Great Britain*," and from that date until the present time he has been adding by his writings to our knowledge of the molluscan fauna of Europe and the North Atlantic. His most important works are: "*British Conchology*," in five volumes, and a series of papers (unfortunately unfinished) in the Proceedings of the Zoological Society, on "*The Mollusca of the 'Lightning' and 'Porcupine' Expeditions*, 1868-70." At the age of twenty he was elected a F.L.S., and in 1840 F.R.S., and he was an honorary LL.D. of St. Andrews. He was one of the most regular members of the Royal Society Club, and took great interest in the meetings of the British Association, which he almost always attended, taking a more active part in 1848, when Local Treasurer at the first meeting at Swansea, in 1880, when a Vice-President at the last meeting held in the same town, and in 1877, when President of the Biological Section. For many years he was Treasurer of the Linnean, and also of the Geological, Society.

Dr. Gwyn Jeffreys's profession was the law. He practised as a solicitor at Swansea until 1856, in which year he was called to the bar, but soon afterwards altogether retired from business. He then left London, and went to reside at a fine old house, Ware Priory, which he had purchased in Hertfordshire. Here it was his delight to hospitably entertain his scientific friends and any foreign naturalists of kindred tastes to his own who might be visiting London.

He may be considered perhaps as the father of dredging in our seas. When practising as a solicitor he was diligent in his profession, and could only spare himself short holidays; yet as early as 1841 he paid his first visit to Shetland. Through a number of years, when unable to give much time himself to collecting, he joined Mr. Barlee in partnership, and while his friend gave his whole time to dredging and collecting, Jeffreys shared the expense and the mollusca.

Shortly after Barlee's death Jeffreys was enabled to devote himself more exclusively to scientific work, and from this time commenced an important series of dredging operations which continued to the last. His friends were now the late Mr. Waller and the Rev. A. M. Norman, and in company with these naturalists explorations were made of the most important parts of the British coasts. A yacht, the *Osprey*, at first lent by Dr. Gwyn Jeffreys's brother-in-law, Mr. Nevill, but subsequently purchased by him, was employed in these investigations. The summers of 1861, 1862, 1863, 1864, 1867, and 1868 were spent in dredging, down to 170 fathoms, the sea around the Shetland Islands; in 1865 Guernsey and Jersey were visited; in 1866 the Minch; and in 1870 the deep water off Valentia on the south-west of Ireland.

Private enterprise now gave way to Government expeditions. In 1869 H.M.S. *Porcupine* was sent to explore that portion of the Atlantic which lies off our western shores, and Dr. Gwyn Jeffreys had charge of the scientific work of the first cruise off the west of Ireland. In the succeeding year (1870) the same vessel was sent to investigate the great depths off the southern coasts of Europe, and Jeffreys was the naturalist on board during the first cruise, which was off the Spanish and Portuguese coasts. In 1876 he went in H.M.S. *Valorous*, which accompanied the last Arctic Expedition as far as Baffin's Bay, when very successful dredging was carried on in Davis Strait and the North Atlantic Ocean during the homeward voyage. In 1880 he and his friend, Dr. Norman, by invitation of the French Government, took part, with a staff of naturalists of that country, in dredgings in great depths off the Bay of Biscay in *Le Travailleur*. In 1878 and 1879 Drs. Gwyn Jeffreys and Norman went together to Norway and dredged Öster Fiord to the north of Bergen, the Hardanger Fiord, and at Dröbak on the Christiania Fiord.

Besides all this direct scientific collecting Dr. Jeffreys for many years has been in the habit of taking a tour on the Continent for the purpose of carefully examining all leading and typical collections of European mollusca, and more especially the products of the various deep-sea expeditions of other nations.

He married a daughter of the late R. J. Nevill, Esq., of Llangennech Park, Carmarthenshire, a talented and accomplished woman who predeceased him, and has left six children.

Dr. Gwyn Jeffreys was J.P. for the counties of Glamorganshire, Breconshire, and Hertfordshire, and for the last county was also a D.L., and served as High Sheriff in 1877.

It cannot but be a matter of deep regret to all British naturalists that Dr. Gwyn Jeffreys's magnificent and unequalled collection of European mollusca, amassed with so much labour and toil and expense, rich to overflowing with types not only of species described by himself, but by almost every author, should go out of this country. Two years ago it was purchased by the American Government. We congratulate our Transatlantic cousins on having it, but it would have been of far greater value in Europe.

ALEXANDER MURRAY, C.M.G.

BY the death of Mr. Alexander Murray, Canadian geology has lost one of its veteran pioneers. This estimable man belonged to a good Perthshire family, and was born at his father's estate of Dollerie in 1811. He went into the navy at the age of fourteen, served in the Mediterranean and was present at the battle of Navarino, was subsequently employed in the West Indies, Halifax, and other stations, and finally quitted the service in 1837. There being no prospect of his advancement in the pursuit of war, he turned his attention to the arts of peace, went to Canada, and bought land there with the view of settling as a farmer. During the rebellion which broke out soon after his emigration he had once more an opportunity of seeing active service. But he had not yet found the proper field for the exercise of his powers. His attempts at farming failed, and his prospects were rather blank, when at last he made the acquaintance of Mr. W. E. Logan, then starting the Geological Survey of Canada. He had had no training in science of any kind, but the mode of life offered by the Survey seemed just what he longed for, and he gladly accepted the proposal that he should join the staff. Before actually beginning his new duties he resolved to do what he could to qualify himself for them. He returned to this country, studied geology theoretically at Edinburgh, and afterwards practically in Wales. In 1843 he went back to Canada and at once began work, remaining at his post for twenty years. He was one of the first and ablest of the stratigraphers with whom Logan traced out the general geological structure of the Dominion. His explorations extended over most of the settled parts and over a large area of forest-land in Western Canada, where he laid down the main lines of structure and the areas of distribution of the rocks. He likewise examined parts of Gaspé and other tracts in the eastern portion of the Dominion. But his most important labours were devoted to the investigation of Newfoundland, of the Geological Survey of which he had charge from 1863 to 1883. From 1866 onwards he prepared an Annual Report of the progress of his work in that colony. These Reports collected by him, and republished as a volume in 1881, contain a summary of all that is known regarding the geological structure of Newfoundland, and will remain as a lasting monument of Mr. Murray's skill as a stratigraphical geologist, and of the courage, patience, aad tact with which he overcame all physical and political difficulties. One of his last labours was the completion and publication of a geological map of the whole of Newfoundland—a work at once beautiful in execution and of the first importance in regard to the industrial growth of the colony. Very few of our colonies yet possess complete geological maps, and hardly ever are they so largely the work of one man as this one. Newfoundland has never adequately recognised how much it stands indebted to Mr. Murray for his share in laying the foundation on which its future development must rest.

SEARLES V. WOOD

AMONG the recent losses which have befallen the geologists of this country not the least is the death of Mr. Searles V. Wood. Himself the son of a geologist, he began his scientific work early in life. He may be said to have been educated upon Tertiary geology, and though at first disposed to wander intc wider fields of research and speculation, it was in tracing the history of the younger formations that he did his best work and spent the chief part of his scientific career. Since the year 1864 he has been unweariedly engaged in investigating the history of the Pliocene and Post-pliocene deposits of the East of England. Taking up this subject in conjunction with Mr. Harman, he soon became convinced that no satisfactory progress could be made in it until the deposits in question had been actually mapped in some detail. Accordingly the two observers began to trace them on the one-inch Ordnance Map, Mr. Wood taking the southern half of the area, including Essex and nearly the whole of Suffolk. This survey, which for minuteness and accuracy has seldom been equalled by the work of any private workers, remains unpublished, though a reduction of it, on the scale of four miles to an inch, was issued in 1872. Mr. Wood eventually gave up his business, which was that of a solicitor, in order to devote himself with more uninterrupted zeal to the prosecution of his favourite science. The bodily feebleness which debarred him from much active work out of doors seemed only to quicken his energy for literary labours. Some of the best fruits of his life-long devotion were gathered into his two long memoirs on "The Newer Pliocene Period in England," published in 1880 and 1882 by the Geological Society. But his friends anticipated much useful work still to come from one who had pursued his studies with such intelligence and zeal, and who had only reached his prime. In his death, at the age of fifty-four, they mourn one who was ever ready cheerfully and helpfully to impart to others the knowledge he possessed himself, who never hesitated to admit an error when he recognised it, and who leaves behind him a notable example of quiet fortitude and enthusiasm.

A SUNSHINE RECORDER

On June 28 of last year I had the honour of bringing before the Physical Society a preliminary notice of a new sunshine recorder,[1] and as we have now had more than six months' experience of its working, it is possible that some of your readers might be interested in hearing of the results obtained.

The apparatus is of simple construction. It consists of a glass sphere silvered inside and placed before the lens of a camera, the axis of the instrument being placed parallel to the polar axis of the earth. The whole arrangement will be readily understood by an inspection of Fig. 1. The light from the sun is reflected from the globe, and some of it, passing through the lens, forms an image on a piece of prepared paper within the camera. In consequence of the rotation of the earth, the image describes an arc of a circle on the paper, and when the sun is obscured, this arc is necessarily discontinuous. The image is not a point, but a line, and in certain relative positions of the sphere, lens, and paper, the line is radial and very thin, so that the obscuration of the sun for only one minute is indicated by a weakening of the image.

In the actual apparatus the sphere is an ordinary round-bottomed flask about 95 mm. in diameter, and the lens a simple double convex lens of about 90 mm. focal length. The sensitive paper employed is the ordinary ferro-prussiate paper now so much used by engineers for copying tracings. This was selected in consequence of the ease with which the impression is fixed, for the paper merely requires to be washed in a stream of water for six minutes, no chemicals being necessary. When the paper is dry, radial lines containing between them angles of 15° are drawn from the centre of the circular impression, and thus give the hour scale, the time of apparent noon being of course given by a line passing through the plane of the meridian. Fig. 2 is a copy of the record of June 27, 1884; in the morning the sun shone brightly, towards noon clouds began to form, and in the afternoon the sky was hazy. The field in which the instrument is placed is surrounded by trees, so the ends of the trace are cut off sharply by shadows.

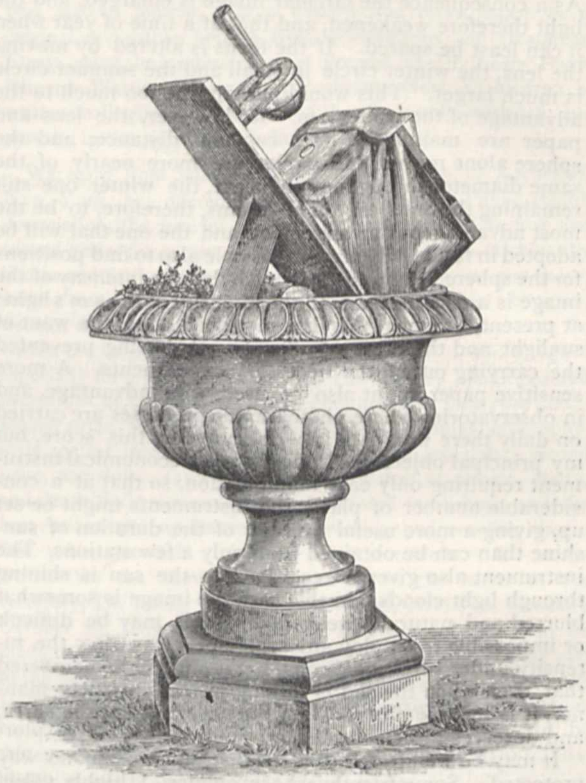


FIG. 1.

With the alteration of declination of the sun, the light entering the camera is reflected from different portions of the sphere, and an alteration of the position of the focus results. This may be corrected in three ways: by moving

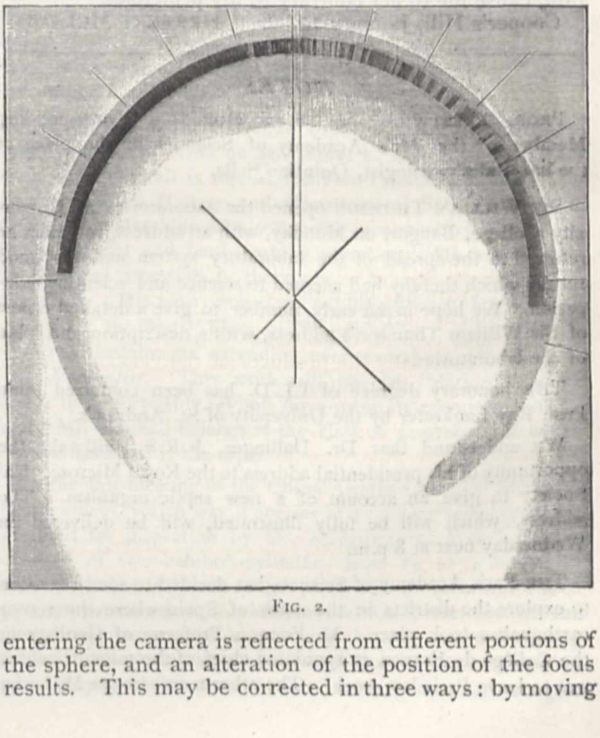


FIG. 2.

[1] *Proc. Phys. Soc.*, vi. 216; *Phil. Mag.*, August 1884, p. 141.

(1) the paper, (2) the lens, or (3) the sphere. In the present apparatus the first method has been adopted, and now the camera is about twice as long as it was in June. As a consequence the circular image is enlarged, and the light therefore weakened, and that at a time of year when it can least be spared. If the focus is altered by moving the lens, the winter circle is small and the summer circle is much larger. This would perhaps be too much to the advantage of the winter sun. If, however, the lens and paper are maintained at a constant distance, and the sphere alone moved, the circles are more nearly of the same diameter throughout the year, the winter one still remaining the smallest. This seems, therefore, to be the most advantageous arrangement, and the one that will be adopted in future. It may be possible also to find positions for the sphere, lens, and paper such that the intensity of the image is a true measure of the intensity of the sun's light; at present, however, this has not been done, the want of sunlight and the press of official work having prevented the carrying out of the necessary experiments. A more sensitive paper might also be used with advantage, and in observatories where photographic processes are carried on daily there would be no difficulty on this score, but my principal object was to devise some economical instrument requiring only easy manipulation, so that at a considerable number of places the instruments might be set up, giving a more useful average of the duration of sunshine than can be obtained from only a few stations. The instrument also gives a record when the sun is shining through light clouds; in this case the image is somewhat blurred and naturally weakened, and it may be difficult or impossible to employ any scale for measuring the intensity under such conditions, but it must be remembered that, even when the sun is shining in this imperfect manner, it is really doing work on the vegetation of the earth, and deserves to be recorded.

It may be well to say that the instrument is in no way protected. Some friends, whose opinion I highly value, urged me to patent it; but as I strongly hold the view that the work of all students of science should be given freely to the world, the apparatus was described at the Physical Society a few hours after the advice was given, lest the greed of filthy lucre should, on further deliberation, cause me to act contrary to my principles.

Cooper's Hill, January 20 HERBERT MCLEOD

NOTES

PROF. PRESTWICH has been elected a Corresponding Member of the Paris Academy of Sciences in the place of the late Italian geologist, Quintino Sella.

SIR WILLIAM THOMSON opened the laboratories at University College, Bangor, on Monday, with an address, in which he referred to the spread of the laboratory system and the good results which thereby had accrued to science and scientific education. We hope in an early number to give a detailed report of Sir William Thomson's address, with a description and plan of the laboratories.

THE honorary degreee of LL.D. has been conferred upon Prof. Ray Lankester by the University of St. Andrew's.

WE understand that Dr. Dallinger, F.R.S., will take the opportunity of his presidential address to the Royal Microscopical Society to give an account of a new septic organism. The address, which will be fully illustrated, will be delivered on Wednesday next at 8 p.m.

THE Paris Academy of Sciences has decided to send a mission to explore the districts in the south of Spain where the recent earthquakes took place. M. Fouqué, Professor of Geology in the Collège de France, is appointed chief of the mission, which was to leave Paris last week. The other members are M. Lévy, mining engineer and sub-director of the geological laboratory of the College of France; M. Bertrand, mining engineer; M. Barrois, of the Faculty of Sciences at Lille; and MM. Killian and Oppret, of the College of France.

AMONGST the honorary members elected to the Italian Society of Geography at its meeting of the 25th ultimo was Mr. Joseph Thomson.

A MEETING of much interest was held at the Rooms of the Asiatic Society on Monday in connection with the establishment of a British School of Archæology at Athens. Already Germany, France, and the United States have been in the field for some time; but though the Greek Government has presented to the English Society a choice site of considerable extent for a school, funds are lacking wherewith to erect the building and carry on the work. We need not insist on the value of archæology in historical research,—all the speakers on Monday were agreed as to that; for a scientific knowledge of the past, it bears the same relation to academical study as the researches carried on by the Naples station do to the home study of biology. At present only 4000*l.* are in the hands of the Committee, but four or five times that amount is required ere the School can start with any hope of efficient work. There are several learned societies with ample means, interested in the varied work which would be carried on by such an institution, and to these, and to individuals who have money to spare and wish to put it to a good use, we commend the scheme. The treasurer is Mr. Walter Leaf, Old Change, E.C.

WE regret to learn of the death of M. Dupuy de Lôme at the age of sixty-eight years. M. de Lôme was well known as a naval engineer, and his name is intimately associated with modern ballooning.

THE Council of the Royal Meteorological Society have arranged to hold, at 25, Great George Street, S.W. (by permission of the President and Council of the Institution of Civil Engineers), on the evenings of March 18 and 19 next, an Exhibition of Sunshine Recorders and Solar and Terrestrial Radiation Instruments. The Exhibition Committee invite the co-operation of those interested, as they are anxious to obtain as large a collection as possible of such instruments. The Committee will also be glad to show any new meteorological apparatus invented or first constructed since last March; as well as photographs and drawings possessing meteorological interest.

IN his inaugural address as Lord Rector at St. Andrew's last week, Lord Reay stated very forcibly his ideas of what a university should be at the present day, encouraging every form of culture and research. Referring to science, Lord Reay asked: "Are we to have a separate Faculty of Science? I should say certainly. Just look at the field covered by a Faculty of Science. It is preparatory for medical science, and our engineers, our manufacturers, our analysts, our botanists, our zoologists, our astronomers, our naval constructors, our geologists, our biologists, our physiologists, our mineralogists, our agriculturists, should obtain scientific degrees. I do not see why a faculty having such an immense area should remain linked with another which has quite different objects to pursue. The same work done by the French École Polytechnique I wish to see done at the universities; and if the Germans have lately spent 340,000*l.* on a new college for technical education at Berlin, I should like to ask what possible reason can be adduced for stinting science-teaching in Scotland at a moment when the report on technical instruction has pointed out that 'theoretical knowledge and scientific training are of pre-eminent importance, as in the case of the manufacturer of fine chemicals, or in that of the metallurgical chemist, or the electrical engineer, and that to these the higher technical instruction may with advantage be extended to the age of twenty and twenty-two.' Here, then, is a clear case even for a

Philistine to grant Government aid. With reference to the science faculty, I should like to make a remark which applies also to the other faculties, but very specially to this faculty. I should wish to give it considerable power to establish lectureships on any special subject for which a specially gifted man should be found. Though the number of his pupils might be very limited, the publication of the results of his research, carried on at the University, would raise it in what I should like to call the international scale. Besides, the knowledge of such prizes being attainable would stimulate original research among the most brilliant undergraduates. I wish those lecturers to be incorporated in the University."

WE have received the Report of the Board of Managers of Yale College Observatory for 1883-84. Dr. Elkin is doing good work with the heliometer. The principal lines of investigation to which attention has been directed are as follows :—"(1) The triangulation of the Pleiades. The interest attaching to this work will lie both in the new and independent determination of the relative positions of the stars of this important zodiacal group and in the comparison with the similar determination made with the Königsberg heliometer nearly half a century ago, as well as with the later Paris results. The plan adopted will furnish, it is hoped, trustworthy tests of the reliability of the instrument both for absolute and relative distances and angles of position. From February 24, the date of the arrival of the reversing eye-pieces from Messrs. Repsold, to April 12, after which the stars are lost in the sun's rays, about one-third of the proposed plan has been accomplished. As the group will come into favourable position for observation during the last four months of the year, there is, therefore, all reasonable hope to finish the work during that time. (2) A considerable amount of time has been devoted to the determination of places of the moon relative to stars within measuring-reach of the heliometer. The principal object in view is the determination of the parallactic inequality in the moon's motion, the deduction of which from meridian and other observations is, as is well known, attended with some difficulty. (3) Advantage has been taken of the favourable opportunity afforded by the approaching inferior conjunction of Venus for a series of observations on the diameter of this planet, of which a number have been already secured."

A CIRCULAR from Mr. H. H. Warner, of the Rochester (U.S.) Astronomical Society, gives the following information as to the Warner Astronomical Prizes :—First. Two hundred dollars for each and every discovery of a new comet made from February 1, 1885, to February 1, 1886, subject to the following conditions :—(1) It must be discovered in the United States, Canada, Mexico, West Indies, South America, Great Britain, and the Australian Continent and Islands, either by the naked eye or telescope, and it must be unexpected, except as to the comet of 1815, which is expected to reappear this year or next. (2) The discoverer must send a prepaid telegram immediately to Dr. Lewis Swift, Director Warner Observatory, Rochester (N.Y.), giving the time of the discovery, the position and direction of motion, with sufficient exactness, if possible, to enable at least one other observer to find it. (3) This intelligence must *not be communicated to any other party or parties*, either by letter, telegraph, or otherwise, until such time as a telegraphic acknowledgment has been received by the discover from Dr. Swift. Great care should be observed regarding this condition, as it is essential to the proper transmission of the discovery, with the name of the discoverer, to the various parts of the world, which will be immediately made by Dr. Swift. Discoverers in Great Britain, the Australian Continent and Islands, West Indies, and South America are absolved from the restrictions in conditions (2) and (3). Second. Mr. Warner will also give a prize of 200 dols. in gold to any person in the world who will write the best 3000-word paper on the cause of the atmospheric effects ("red light," &c.) accompanying sunset and sunrise during the past sixteen months. It is desired that these papers be as original as possible, both in facts, observations, and treatment. Essays must be exclusively sent prepaid to Dr. Lewis Swift, Director Warner Observatory, Rochester, New York, must be written in English, on one side of the paper only, with ink, and must be in the simplest untechnical phrase.

WE learn from *Science* that Mr. Henry Lomb, of Rochester, New York, has offered, through the American Public Health Association, the sum of 2800 dols., to be awarded as first and second prizes for papers on the following subjects :—(1) Healthy homes and foods for the working classes : first prize, 500 dols. ; second prize, 200 dols. Essays to be of a practical character, devoid, as far as possible, of scientific terms. They must be within the scope and understanding of all classes, and designed especially for a popular work. (2) The sanitary conditions and necessities of schoolhouses and school-life : first prize, 500 dols. ; second prize, 200 dols. (3) Disinfection and individual prophylaxis against infectious diseases : first prize, 500 dols. ; second prize, 200 dols. (4) The preventable causes of disease, injury, and death, in American manufactories and workshops, and the best means and appliances for preventing and avoiding them : first prize, 500 dols. ; second prize, 200 dols. All essays written for the above prizes must be in the hands of the secretary, Dr. Irving A. Watson, Concord, N.H., on or before October 15, 1885. It is expected that arrangements can be made to have these essays widely distributed to the public, and to the persons mostly interested in the respective subjects in the United States. The American Public Health Association earnestly appeals to those able to compete, to take part in this work, which, it is believed, will do much to augment the health, comfort, and happiness of the people.

WE are glad to notice that classes for the instruction and study of elementary astronomy have been established by the Liverpool Astronomical Society, and will meet every Tuesday in the Association Hall, Mount Pleasant. The opening meeting of the class was held on Wednesday, January 21, at—we are informed—twenty o'clock (eight p.m.), when Mr. Isaac Roberts, F.R.A.S., F.G.S., presided and addressed the students. The class throughout the course will be conducted by Mr. James Gill, of the Liverpool School of Navigation.

THE distinction of Associate of the Linnean Society has recently been conferred on Mr. James E. Bagnall, of Birmingham. Mr. Bagnall is one of the Vice-Presidents of the Birmingham Natural History and Microscopical Society, of which he has for something like a quarter of a century been one of the most useful and hard-working members. He has devoted his principal attention to the study of botany—structural and systematic. His most important published work is the latest and by far the best "Flora of Warwickshire," which has appeared by instalments extending over several years in the *Midland Naturalist*. This work will, we are informed, shortly appear in a thoroughly revised form as an independent publication. Mr. Bagnall belongs to the class of naturalists of which Thomas Edwards is the type.

AT the last meeting of the China Asiatic Society at Shanghai an instrument, which was a species of primitive telephone, was presented for inspection by Dr. Macgowan of Wenchow. It consisted of two bamboo cylinders, from 1½ to 2 inches in diameter, and 4 inches in length ; one end of each was closed by a tympanum of pig-bladder, which was perforated for the transmitting string, the latter being kept in place by being knotted. This rude instrument is called the "listening tubes," and is employed for amusement as a toy, conveying whispers

40 or 50 feet. It is unknown in many parts of China, the provinces of Che-kiang and Kiangsu being the only ones, so far as can be ascertained, where the listening tubes are employed. Besides this toy, Chinese ingenuity produced, about a century and a half ago, the "thousand mile speaker." This implement is described as "a roll of copper, likened to a pipe, containing an artful device; whispered into, and immediately closed, the confined message, however long, may be conveyed to any distance, and thus, in a battle, recent instructions may be conveniently communicated. It is a contrivance of extraordinary merit." The inventor of the "thousand-mile speaker," one Chiang Shun-hsin, of Huichou, flourished during the reign of Kang-hsi, during parts of the seventeenth and eighteenth centuries. He wrote on occult science, astronomy and foreign physics, and the above description of his invention was copied from his works into a provincial encyclopædia. At the time the latter work was published—in the reign of Kien Long—there was no longer an instrument of this kind in the province, as the ingenious invention appears to have perished with the student who contrived it.

THE following very interesting table has been compiled from the records of the meteorological observatory at Tokio. It gives the total number of recorded earthquakes which occurred in the respective months during the ten years ending December 10, 1884:—

January	53	July	36
February	50	August	27
March...	73	September... ...	15
April	43	October	47
May	51	November	51
June	40	December	60

The list would, of course, need to be in full detail for each month of each year, in order that any safe deduction might be made from it; but the general notion that there are more earthquakes in winter than in summer receives some support from this table. The average per month for the ten years is 45; that for the six winter months (October–March) is 56; and for the six summer months 35, or about 40 per cent. less. An important element of disturbance in the figures would be the great improvement in seismological instruments since 1874, and the consequent registration of movements which would previously have passed unnoticed.

THERE have been a number of earthquake shocks during the past week. Another severe shock, accompanied by what is described as a tremendous report, occurred at Alhama, on January 27. By the fall of a house one person was killed and two others were injured. On the 27th and 28th fresh shocks occurred in the hot spring district of Southern Styria; also at four o'clock on the morning of the 27th a severe and prolonged shock was felt at Valparaiso. On the 31st a shock occurred at Algiers, destroying eight Arab houses. The shock was also felt at Setif.

MR. JAMES JACKSON, of the Paris Geographical Society, has issued a new and much extended list of various speeds in metres per second. It begins with the Mer de Glace at 0·0000099 m. per second, and concludes with the current from a Leyden jar in a copper wire of 0·0017 m. at 443,500,000 m. per second.

WE are glad to see that the *Health Journal*, the first number of which we noticed, is still continuing to do good work in connection with sanitary science. We have before us the twenty-first number, which contains several useful articles. We commend the *Journal* to the notice of those interested in the subject. It is published by Heywood, of Manchester.

THE *Journal de Saint-Pétersbourg* states that the first Russian school for Mussulmans has been opened at Tashkend. The pupils, who belonged to the families of native notables, numbered forty-one at the commencement. It is proposed to open schools of the same kind elsewhere.

WHEN M. Barral died he had written the larger part of a "Dictionnaire d'Agriculture." The first number, which contains 250 pages large 8vo, two columns, closely printed, has just been published by Hachette and Co. About twelve similar parts will follow in the course of four or five years.

THE additions to the Zoological Society's Gardens during the past week include a Malbrouck Monkey (*Cercopithecus cynosurus* ♂) from West Africa, presented by Mrs. East; a Sambur Deer (*Cervus aristotelis* ♂) from Madras, presented by the Officers 1st Battalion Essex Regiment; a Long-eared Owl (*Asio otus*), a Tawny Owl (*Syrnium aluco*), British, presented by Mr. Geo. E. Crisp; a Malayan Tapir (*Tapirus indicus* ♂) from Malacca, a White Stork (*Ciconia alba*), European, two Magpies (*Pica rustica*), British, deposited; two Calandra Larks (*Melanocorypha calandra*), European, purchased; five Striped Snakes (*Tropidonotus sirtalis*), born in the Gardens.

OUR ASTRONOMICAL COLUMN

THE OCCULTATION OF ALDEBARAN ON FEBRUARY 22.—In the occultation of Aldebaran on the 22nd of the present month, the immersion takes place while the sun is above the horizon in this country, and the emersion soon after sunset. The following times and angles are founded upon the data of the *Nautical Almanac*, the angles being reckoned as in that work; the times are Greenwich mean times at the respective observatories:—

	Immersion h. m.	Angle from N. point °	Emersion h. m.	Angle from N point °
Greenwich... ...	5 16·6	36	5 49·6	344
Oxford	5 13·3	40	5 49·7	341
Cambridge ...	5 14·9	41	5 52·6	339
Dublin	5 1·8	52	5 50·0	329
Liverpool	5 7·3	49	5 53·3	331
Glasgow	5 3·7	60	5 57·9	320
Edinburgh... ...	5 5·3	59	5 59·3	321

VARIABLE STARS.—Dr. Gould notifies the detection of three new variable stars at Cordoba, which he calls respectively R Lupi, R Piscis Austrini, and R Phœnicis. In his communication to the *Astronomische Nachrichten* he refers to his recently published zones for their positions, which, brought up to the beginning of the present year, will be:—

	R.A. h. m. s.	Decl. ° '
R Lupi	15 46 1	−35 57·2
R Piscis Austrini ...	22 11 28	−30 10·7
R Phœnicis	23 50 29	−50 25·6

By Argelander's formula of sines the last maximum of *Mira* should have occurred on January 28, but the maxima and minima of the last four or five years appear to have taken place between a fortnight and three weeks earlier than the dates assigned by the formula. Perhaps some reader of NATURE may be able to fix the time of the recent maximum from his own observations.

WOLF'S COMET.—The following ephemeris of Wolf's comet of short period is deduced from Herr Thraen's ellipse, which depends upon normal places to November 23. The comet was observed without difficulty at Lund on January 20:—

At 6h. Greenwich Mean Time

1885	R.A. h. m. s.	Decl. ° '	Log. distance from Earth	Log. distance from Sun
Feb. 6	2 10 44	−3 2·7	0·2569	0·2478
7	2 13 8	2 55·6		
8	2 15 31	2 48·6	0·2628	0·2500
9	2 17 55	2 41·5		
10	2 20 18	2 34·4	0·2687	0·2522
11	2 22 41	2 27·2		
12	2 25 4	2 20·0	0·2745	0·2544
13	2 27 26	2 12·8		
14	2 29 48	−2 5·5	0·2803	0·2567

TEMPEL'S COMET, 1867 II.—Reference has been already made in this column to the impossibility of making any reliable prediction of the track of this comet at its approaching return, without a calculation of the perturbations since it was last observed in 1879, owing to its having passed pretty near to the planet Jupiter in 1881. It appears from a communication to the *Astronomische Nachrichten* that M. Raoul Gautier, of Geneva, is engaged upon a determination of the effect of the planet's attraction, and hopes to furnish observers with an ephemeris which may enable them to find the comet without difficulty. M. Gautier states that up to the time of minimum distance of the two bodies (0·55) in October 1881, a retardation of thirty days in the epoch of next perihelion passage had been caused by the planet's action, and it is not to be expected that the comet can arrive at perihelion before the end of June or beginning of July, though without perturbation it would have been due at the beginning of May.

ASTRONOMICAL PHENOMENA FOR THE WEEK 1885, FEBRUARY 8–14

(FOR the reckoning of time the civil day, commencing at Greenwich mean midnight, counting the hours on to 24, is here employed.)

At Greenwich on February 8

Sun rises, 7h. 29m.; souths, 12h. 14m. 25·6s.; sets, 17h. 0m.; decl. on meridian, 14° 50′ S.: Sidereal Time at Sunset, 2h. 16m.

Moon (2 days past Last Quarter) rises, 2h. 20m.; souths, 6h. 59m.; sets, 11h. 34m.; decl. on meridian, 16° 44′ S.

Planet	Rises h. m.	Souths h. m.	Sets h. m.	Decl. on Meridian ° ′
Mercury	6 39	10 45	14 52	21 26 S.
Venus	6 38	10 48	14 58	20 49 S.
Mars	7 36	12 18	17 0	15 39 S.
Jupiter	18 1*	1 6	8 11	11 48 N.
Saturn	11 46	19 49	3 52*	21 33 N.

* Indicates that the rising is that of the preceding, and the setting that of the following nominal day.

Phenomena of Jupiter's Satellites

Feb.	h. m.		Feb.	h. m.	
9	4 27	I. ecl. disap.	11	6 5	II. occ. reap.
	6 59	I. occ. reap.		20 22	I. tr. ing.
	19 53	III. occ. reap.		22 41	I. tr. egr.
10	1 56	I. tr. ing.	12	19 51	I. occ. reap.
	4 16	I. tr. egr.		21 26	II. tr. ing.
	22 55	I. ecl. disap.	13	0 21	II. tr. egr.
11	1 25	I. occ. reap.		5 54	III. tr. ing.
	2 45	II. ecl. disap.	14	19 12	II. occ. reap.

Feb.	h.	
11	12	Mars in conjunction with the Sun.
12	0	Mercury in conjunction with and 0° 44′ south of Venus.
12	9	Mercury at greatest distance from the Sun.
13	10	Venus in conjunction with and 5° 9′ south of the Moon.
13	11	Mercury in conjunction with and 5° 58′ south of the Moon.

Note.—In the two preceding weeks the word *left* in the heading of the last column of the "Occultations" should have been *right*. The angles are understood to apply, as usual, to the inverted image.

GEOGRAPHICAL NOTES

THE Commission which was originally appointed to investigate the possibility of a maritime canal across the isthmus of Krao, in the north of the Malay Peninsula, has continued its exploration in this unknown region. It is composed of M. Delonell, accompanied at first by M. Paul Macey, Mr. Davidson, an English engineer, and a Siamese commissioner. Their second visit to the place was made in the spring and summer of last year. After ascending the peninsula from the isthmus of Krao to 7° 13′ N. latitude, and visiting the Samuil Islands, the most interesting and least known of the archipelagoes in the Gulf of Siam, the expedition penetrated the peninsula to the height of Singora, 7° 14′ N. latitude, where they discovered the existence of a State, Sam-Sam, composed of mestizos, or half-caste Malays and Siamese, the former haunt of pirates and semi-independent of Siam. By wide and deep channels which enter far into the country, the party were conducted to a large inland sea, called Talé-Sab, which they were the first Europeans to visit. This was found to be about 6 metres in depth, and 45 miles long by 12 wide, of a curious configuration, with small islands covered with the nests of sparrows. The water is fresh during the north-east monsoon, but brackish during the south-west; it separates the peninsula properly so-called from the island of Tantalam (or Ko Yai in Siamese) by a number of *arroyos*, which stretch from Singora in the south to Lacon in the north. The party landed at Taloung on the west side, at 7° 40′ N. latitude, where a Sam-Sam rajah supplied them with elephants to cross the peninsula. They crossed a large plain under rice cultivation to the borders of Klong Taloung, then reached the chain of Louang Mountains, which forms the end of the peninsula, and then descended the Tsang River, which flows into the Bay of Bengal. Three visits in all were made to these regions during the year, and the States of Tsang, Taloung, Lacon, Singora, and Stouil were thoroughly explored. The engineers have already made their geological reports of the whole regions, and certain specimens which have been analysed at the School of Mines in Paris shows that deposits of auriferous quartz, tin, and iron exist in this *terra incognita*. Numerous ethnographical observations were also made on the Sam-Sam, their government, and habits of piracy.

MR. A. R. COLQUHOUN has published a notice in the Eastern journals with regard to his projected exploration of the Shan States. His colleague, Mr. Holt Hallett, after consulting with him concerning the further exploration and survey of Siam and the Shan country, has left China for Bangkok, in order there to hold an interview with the King of Siam on the subject. He will thence proceed to Rangoon and Calcutta, to report to, and consult with, the Chief Commissioner of British Burmah and Lord Dufferin. From Calcutta Mr. Hallett will proceed to London to submit his reports to the Royal Geographical Society and the Chambers of Commerce which have supported the exploration survey. Any exploration on the southern frontier of China, such as was intended to be included, is for the present out of the question, owing to the unsettled condition of the frontier regions. The continuation of the explorations in Siam and the Shan country depends on the result of Mr. Hallett's visit to Siam and India. A preliminary report has been drawn up by Messrs. Colquhoun and Hallett, dealing with the first year's operations, which will be published on Mr. Hallett's arrival in England.

AT the meeting of the Geographical Society of Paris on the 23rd ult., M. Mascart president, M. Thouar, known for his journey in search of the remains of the Crevaux expedition, announced that he is about to start on his fourth journey in South America. His project is to ascend the Paraguay, and study the delta of the Pilcomayo, where Crevaux perished, and then to investigate the possibilities of a trade route between Bolivia and the Paraguay. M. Thouar will then carry out the mission with which he is charged by the Bolivian Government—viz. in company with some engineers and naturalists, to study the whole of Bolivia from scientific, industrial, and commercial points of view.—M. Cabres described some episodes of a journey which he recently made to Bokhara; and M. Rey presented to the Society a new map of the north of Syria, designed by M. Thuillier.

UNDER the title of "Un' Estate in Siberia fra Ostiacchi, Samoiedi, Sirieni, Tatari, Kirghisi e Baskiri" (Florence, 1885), Signor Stephen Sommier describes a voyage which he made down the Obi from its confluence with the Irtish to its mouth in the Arctic Ocean. He made during the journey interesting observations on the course of the river, and on the temperature of the water. Towards the end of July the mean temperature was 18° above zero, even at the mouth of the river, and in August it was still +10°. These have much importance, for the question of the navigability of the Kara Sea. Under the influence of these masses of warm water, the coast ice should melt, and consequently the icebergs which have in recent years blocked the straits giving access to the Kara Sea cannot be of great extent. The most important part of the volume, however, is that devoted to the anthropology and ethnography of the Ostiaks and Samoyedes. On the course of the Obi are groups of habitations where travellers are supplied with rowers, and each time Signor Sommier changed his men—about a hundred times in all—he made anthropological observations, and collected ethnographical objects. These are now in the Ethnographical Museum in Florence, and illustrations of a considerable number of them are found in his work. Besides these tribes, the book also deals with the Bashkirs and Kirghises, whom the author visited in returning to Europe.

THE last *Bulletin* (No. 6) of the Geographical Society of Belgium contains a paper by M. Oscar Royer describing his journey on the Congo; notes on a journey in Texas, by Mr. Lancaster; also "Some words on Atlantis," by M. de Bloek, who regards this fabulous region as merely one of those invented by the ancients for the purpose of working out in imagination their social and political theories. Finally, a study on the first narrative of Columbus, and the old printed editions of it, with a fac-simile of the first "Epistola C. Coloni," printed at Antwerp in 1493.

THE INSTITUTION OF MECHANICAL ENGINEERS

THIS Institution held its annual general meeting in London last week. The list of papers to be read we have already given, though some of them were not read; the only one calling for special notice at our hands is that of Sir Frederick Abel on a "Final Report bearing upon the Question of the Condition in which Carbon exists in Steel." The following are the conclusions which Sir Frederick bases on the present and on the two preceding reports:—

"The results of the experimental work described appear to warrant the following conclusions in regard to characteristics, recognisable by chemical examination, which are exhibited by different portions of one and the same sample of steel presenting marked physical differences consequent upon their exposure to the hardening, annealing, or tempering processes.

(1) In annealed steel the carbon exists entirely, or nearly so, in the form of a carbide of iron, of uniform composition (Fe_3C or a multiple thereof), uniformly diffused through the mass of metallic iron.

"(2) The cold-rolled samples of steel examined were closely similar in this respect to the annealed steel, doubtless because of their having been annealed between the rollings.

"(3) In hardened steel the sudden lowering of the temperature from a high red heat appears to have the effect of preventing or arresting the separation of the carbon, as a definite carbide, from the mass of the iron in which it exists in combination; its condition in the metal being, at any rate mainly, the same as when the steel is in a fused state. The presence of a small and variable proportion of Fe_3C in hardened steel is probably due to the unavoidable and variable extent of imperfection, or want of suddenness, of the hardening operation; so that, in some slight and variable degree, the change due to annealing takes place prior to the fixing of the carbon by the hardening process.

"(4) In tempered steel the condition of the carbon is intermediate between that of hardened and of annealed steel. The maintenance of hardened steel in a moderately heated state causes a gradual separation (within the mass) of the carbide molecules, the extent of which is regulated by the degree of heating, so that the metal gradually approaches in character to the annealed condition: but, even in the best result obtained with blue-tempered steel, that approach, as indicated by the proportion of separated carbide, is not more than about half-way towards the condition of annealed steel.

"(5) The carbide separated by chemical treatment from blue- and straw-tempered steel has the same composition as that obtained from annealed steel.

"It does not appear that this inquiry can be further extended with the prospect of obtaining any additional facts—elucidating the condition of the carbon in steel exhibiting various physical characteristics—the value of which would bear any proportion to the very laborious nature of the necessary experimental work, which has to be conducted with small quantities of material on account of the necessity of carrying out the annealing, hardening, and tempering processes with very thin pieces of steel.

"I believe it will be admitted that, although the data obtained have not led to the discovery of a ready chemical method of differentiating between different degrees of temper in steel (a method of examination which Prof. Hughes's interesting results have almost rendered unnecessary), they have at any rate contributed to the advancement of our knowledge of the nature of steel."

THE INFLUENCE OF DIRECT SUNLIGHT ON VEGETATION

THE influence of direct sunlight on vegetation is generally known, but surely deserves to be a subject of special study. In the following paper we shall only endeavour to describe some facts with relation to this influence. In the first place, the effect of the sun's rays in the tropical regions will be traced, and afterwards in the temperate and arctic zones. The constant high temperature within the tropics is the cause of the plants being less dependent on the direct solar heat than is the case in the greater part of the temperate and cold zones, but, notwitstanding this, there are plants even in the tropical regions requiring for a luxuriant growth the direct rays of the sun.

Of the tropical monocotyledonous plants, the palms are doubtless the most important, and of these the date-palm of the Sahara Desert (*Phœnix dactylifera*, L.) furnishes daily food to the inhabitants of this part of Africa.

It is known that the subterranean wells are the only cause of vegetation in this desert. When a well is discovered, in a short time an oasis arises, and the date-palm appears.

Considering that the first condition for the growth of palms is a humid soil wherein the roots may vegetate, there seems to be at first something strange in the fact of the Great Desert producing species of this family; but the Arabs say that this "Queen of the Oasis" puts her feet in water and her head in the fire of heaven; and this is the cause of the rapid growth of the plant (Greisbach, "Die Vegetation der Erde," Theil ii. p. 87); the water ascends by the roots into the tissue of the tree, and communicates its temperature to the inner parts, so that the influence of the sun's heat is tempered; the evaporation of the plant also causes a lower temperature; thus it withstands a difference of 98° (from 126° to 28°), as occurs in the Desert (Martins, "Le Sahara," *Revue des deux Mondes*, 1864, vol. lii. p. 613).

Though, as we have said above, these plants require, in the first place, water for their roots, the fact of the stems growing in their wild state at a considerable distance the one from the other, and never forming dense forests, proves that they require also the light.

But the date-palm is indigenous to the Great Desert; nowhere else does this plant vegetate so rapidly. When cultivated with success, it is also in a desert-climate, as, for instance, in that of Murcia in Spain (the date forest of Elche), the highlands of Afghanistan, &c. The cause of its culture being without fruits in the Mediterranean is the dry summer, there being no subterranean wells, as is the case in the Sahara.

The sugar-cane (*Saccharum officinarum*, L.) is also a plant requiring the direct solar light; moist climates are disadvantageous to its cultivation. Thus the climate of China, with its heavy rains in May and June (Dove, "Klimatologische Beiträge," vol. i. p. 102), but less precipitation in autumn, when the fruits ripen, is suited for the culture of this plant. It is known that the quantity of sugar depends on the quantity of sunshine.

Turning to the warm temperate zone we see the species of *citrus* cultivated in the sunny climate of Southern Italy, and even by cultivation produce the delicious fruits generally known, because they are in summer under the almost constant influence of the sun's rays in open localities. In the Malayan Peninsula, the supposed native country of these plants, they also grow in open spaces and not in the jungles, requiring a moist soil, but also the solar light, to ripen their fruits; this explains why the finest and largest oranges are obtained when the trees are trained against walls, as is the case in some parts of Southern England.

The vine (*Vitis vinifera*, L.) is also a plant requiring heat in the after summer to ripen its fruits; the climate of Southern France and Italy is therefore well adapted for its cultivation. In the continental climate of Bokhara in Turkestan (40° N. lat.), with its hot summers (in the sandy desert on the Oxus River the soil was found to have a temperature of 144°—Basiner, "Reise durch die Kirgisensteppe nach Chiwa"), the plant is cultivated in the open fields; its winter covering is not taken off before the end of March, but in April the temperature is already very high, and in July it becomes insupportable;[1] the fruit of the vine is ripe by the end of June or the beginning of July. The soil is moistened here by artificial irrigation. A

[1] Mean temperature at Samarkand, lat. 39° 39', in 1881: April 61°, May 70°, June 77°, July 81°, August 77°, September 68°, and December 28°; mean temperature at 1 p.m. in June 86°, in July 93°, in August 92°, in September 81°.

climate with sudden changes of temperature, as, for instance, in the United States, does not suit this plant. On the banks of the Ohio River the fruits are rotten, or fall down, before they are ripe, notwithstanding that the *mean* temperature of all the months at Cincinnati is higher than at Pesth in Austria; but the American species are cultivated with success.

In California, with its equal temperature, the vine is cultivated, though the *mean* temperature at San Francisco is much lower than in Europe in the same latitude; but the dry Californian summer is not to be found throughout the United States, where heavy rains occur at this season.

Everywhere, in the warm as well as in the temperate regions, corn is cultivated with success where there is in summer direct sunlight enough to ripen its grains: on the highlands of Afghanistan, in China, on the plains of Southern Russia, on the highlands of Mexico, &c.—for these plants require also the direct solar warmth.

On highlands the influence of insolation is very much increased. At Leh, in Tibet, altitude about 12,000 feet, the thermometer rose in July, in the sun, to 144°, and in mid-winter to 84°, though the mean summer temperature is only 61°, and that of the winter 16°.[1] Barley is sown about May 18 and harvested on September 12; but in the valley of Pituk (altitude about 11,000 feet) barley was sown and harvested in two months.

But, in the first place, the solar warmth of the *after* summer is necessary to ripen the fruits of the most important plants; for the vine a September temperature of at least 59° is thought to be necessary (Greisbach, "Die Vegetation der Erde," theil i. p. 126). Now, if we compare the means of this month of certain places in Southern England (Greenwich 57°, Penzance 57°, Chiswick 57°, Isle of Wight 58°) with others on the Continent (Liege 61°, Mannheim 62°), we see it is clear that the cloudy sky and rain, and not the *mean* temperature, are the causes of the vine being cultivated without success in England.

The limit of corn cultivation ascends on the Continent generally farther to the north than on the shores—Fort Norman (N.W. Territories of Canada) 65°, Jakutsk 62°.

The fact of its reaching 70° N. lat. in Norway (Alten), and the impossibility of agriculture in Greenland, even under 60°, and in Iceland (Reikiavik), notwithstanding the mean summer temperature of Alten and Reikiavik being about equal,[2] can only be explained by the continual clear sky in summer at Alten, and by the powerful insolation here, which is not the case in Iceland. The continual wet climate and absence of sunlight make the grains rot on the stalks before they are ripe (Martins, "Essai sur la Végétation de l'Archipel des Féroe," pp. 388, 392). The period of vegetation at Alten is the same as that in Siberia (Jakutsk), though the mean summer temperature is 9° lower.

But a climate such as that of Northern Norway, where the shores are free of ice even in mid-winter, caused by the north-east branch of the Gulf Stream, is nowhere to be found on the globe under such a high latitude. On the north-east shores of Asia corn cannot be cultivated even under 50° N. lat. The same latitude is its limit on the eastern shores of America; on the western it reaches about 57°. On the north-east shores of Asia the cause is the ice in the sea of Ochotsk, the wind in summer being mostly south-east or south,[3] thus coming from the sea or along the shores, and causing much lower summer temperatures than in the interior,[4] and cloudy sky. On the north-east shores of North America the corn limit reaches 50° N. lat., the cause being here the ice in Hudson Bay and along the shores of Labrador and Newfoundland.[5] But again, it is not alone the low mean temperature which causes the corn limit to descend so far southerly, but want of sunlight.[6]

[1] Frost is observed in September, and lasts till the end of May. See Moorcroft, "Travels in the Himalayan Provinces."

[2] Summer temperature at Alten 53°, at Reikiavik 54°. See Dove, "Temperaturtafeln."

[3] On account of the barometric summer minimum over the Asiatic continent.

[4] Temperature of Ochotsk, lat. 59° 21′: June 46°, July 55°, August 56°, September 47°. Temperature of Nicolajefsk, lat. 53° 8′: June 54°, July 61°, August 61°, September 50°. See Schrenck, "Reise im Amur Lande," bd. iv. p. 405.

[5] Mean temperature in 1876 at York Factory, lat. 57°: June 49°, July 57°, August 55°. Mean temperature in 1880 at Moose Fort, Ontario, lat. 51° 16′: June 55°, July 59°, August 55°, September 52°. See *Report* of the Meteorological Service in Canada.

[6] Percentage of sky clouded, Nikolajefsk of the Amur: June 58, July 59, August 63. See Schrenck, "Reise im Amur Lande," bd. iv. p. 476. Percentage of sky clouded in 1880 at Moose Fort: June 66, July 62, August 62. Number of rainy days: June 15, July 15, August 20. See *Report* of the Meteorological Service in Canada.

In the vicinity of the arctic zone the influence of insolation is, in the first place, observed on the Continent. At Turuchansk, lat. 65° 55′, gourds are cultivated, though of a small size (Middendorff, "Sibirische Reise," band iv. theil i. p. 701). The mean temperature in 1881 was: Of June 48°, of July 59°, and of August 55°, the two last months being about equal in temperature to the means of Valentia in Ireland, lat. 51° 55′ (July 59°, August 59°); but at Turuchansk there were, in June, 7 days with the temperature, at 1 p.m., ranging between 68° and 73°; in July, 15 days ranging between 68° and 82°; and in August, 16 days ranging between 62° and 75°. Number of days completely clouded: June 6; July 9; August 3. Snow did occur till June 15, and was observed again on August 29 (*Annalen der Physikalischen Central Observatoriums*, St. Petersburg). In Norway the cultivation of gourds (*Cucurbita Pepo*, L.) reaches 59° 55′.

In North America, at Cumberland House, lat. 53° 57′, a sugar harvest is collected from *Negundo fraxinifolium*, Nutt. (*Acer negundo*, L.), by means of cuttings in the trees, but the flow of the sap is greatly influenced by the action of the sun's rays, and is greatest after a smart night's frost (Richardson, "Search Expedition through Ruperts Land," vol. ii. p. 236).

In summer, the influence of the direct sunlight causes the tropical mid-day temperature so common in the interior of both continents in the temperate zone; but in America the days' differences are much greater than in Asia;[1] even near the eastern shores (Montreal, Quebec, &c.) daily differences of 20° are of common occurrence in midsummer.

The Asiatic continent, reaching to the Arctic Sea, without interruption presents to the sun's rays a much greater surface than is the case with America, where the melting ice in Hudson's Bay and the Arctic Archipelago consumes the greatest part of the solar warmth, being at the same time the cause of the sudden low temperatures occurring when the wind turns to the north or north-west.

Notwithstanding this, the European vegetables and corn are cultivated with success in the United States and the interior of Canada, but some of them cannot stand the sudden changes of temperature, as, for instance, the vine, and also the orange-tree (*Citrus aurantium*, L., et varr.); the general cultivation of the latter does not reach beyond 30° N. lat. (Florida).

Nowhere else is the influence of insolation more distinctly observed than in the arctic regions. It is known that in high latitudes the heat of the sun's rays in summer is often very great. Richardson remarks that (being under about 60° N. lat. near the Slave River) he had never felt the heat within the tropics so oppressive as he experienced it on some occasions in these arctic regions (Richardson, "Search Expedition," vol. i. p. 144), though the sun's rays are here always horizontal instead of vertical, as is the case in the tropical countries. The enormous multitude of mosquitoes suddenly appearing in spring when the ice is thawing, and in places where there is water for their larvæ (swamps, pools, &c.), is also much greater than in India.

The observations on the following page may give some idea of the difference between the temperature in the shade and that in the sun's rays.

At Fort Franklin, Great Bear Lake, North America, lat. 65° 12′, the mean temperature in the last part of March or the beginning of April is about 0° F.; the effect of the sun's rays on the blackened bulb of a thermometer, however, is sufficient to raise the mercury to 90° (Richardson, "Search Expedition," vol. ii. p. 254).

Comparing these observations with those within the tropics we see that the difference between the maximum temperature in the sun in these regions and the northern is relatively small. Maximum temperature in the sun, 1882: Calcutta, 162°; Bombay, 151°; Colombo (Ceylon), 157°; Barbados, 156°. But in dry climates the difference is greater: Melbourne, 169°; Adelaide, 180°. The mean humidity at Adelaide was only 58 per cent.; highest temperature in shade 112°.

Even in the North American Arctic Archipelago, in Smith Sound, lat. 78° 30′, where the mean summer temperature is only 33° (June 30°, July 38°, August 31½°), Kane's observations with the black bulb thermometer gave the following results:—

[1] Greatest difference at Winnipeg, lat. 49° 55′, on July 2, 1881, maximum 98°, minimum 45°; difference 53°. At Poplar Heights, Manitoba, lat. 50° 5′, maximum on May 20, 86°, minimum 27°; thus difference 59°. At Blagoweschtschensk, Siberia, lat. 50° 15′, on May 25, 1881, maximum 79°, minimum 48°; difference 31°. At Akmolinsk, lat. 51° 12′, on May 25, maximum 68°, minimum 50°; difference 18°

From May 16 till September 4 the temperature in the sun's rays was constantly above the freezing-point (with exception of May 22, when this was not the case); on June 15 it reached 48°, on the 26th 54°, on July 5, 70°, and on August 11, 66°.

Observations at Pawlov sk, Russia, Lat. 59° 43′[1]

Date, 1881	Temp. in shade	Temp. in the sun's rays	Difference	Humidity
	°	°	°	%
Feb. 8	2	70	68	75
,, 18	21	88	67	74
,, 21	12	88	76	82
,, 24	12	91	79	76
,, 25	18	97	79	71
,, 28	9	91	82	73
March 14	20	106	86	73
,, 16	27	111	84	66
,, 22	20	109	89	65
May 25	68	128	60	39
June 8	82	140	58	40
,, 29	73	133	60	33
July 2	80	138	58	30
Aug. 10	64	131	67	72
Sept. 8	66	124	58	57
,, 18	62	124	62	66
Oct. 10	52	107	55	63
Nov. 4	32	86	54	78

It is clear that the influence of the sun's rays increases with higher latitude, because the sun in summer rests above the horizon.

Now we come to the main point, viz. the effect of the direct solar heat on vegetation in the northern regions.

In Novaya Zemlya the vegetation (consisting chiefly of herbaceous plants) is, in places exposed to the sun's rays (at the foot of mountains), like an arctic flower-garden, the surface of the soil not being covered with grass as is the case in the temperate regions. The flowers are here of a much greater size than the leaves. In this island, and even in Spitzbergen, the snow disappears in summer by the action of the sun from hills exposed to its light; but on Ben Nevis in Scotland, being a difference in latitude of more than 20°, the snow rests sometimes the whole year.

In the Tundra of Siberia, on the declivities of hills sheltered from the winds and exposed vertically to the sun's rays, the same herbaceous vegetation, with its large, splendid-coloured flowers, is observed (Middendorff, "Sibirische Reise," bd. iv. th. i. p. 733), but this is not the case in plains where the sunlight in its horizontal direction cannot have so much influence on the vegetation of the frozen ground; therefore these plains are in general really deserts, only covered with moss.

Insolation is also the cause of the rich vegetation in some parts of the mountains in the temperate zone (Alps, &c.).

Even in the most northern regions there can be a rich vegetation where the plants in sheltered localities are exposed to the sun. Parry ("Attempt to reach the North Pole") found the scurvy grass (*Cochlearia*) on Walden Island under 80° 30′ N. lat. in such a luxuriant growth as he had never seen it before.

Middendorff observed, under 74° 30′ N. lat., on the borders of Lake Taimyr in Siberia, on August 2, a temperature of 52° in the shade; but a heliothermometer under glass placed in the sun's rays stood at 104°; an uncovered one marked, in the sun, 70°. The pitch on his boat was not only melted by this temperature, but flowed (Middendorff, "Sib. Reise," p. 657).

But, as is the case also in lower latitudes, the greatest difference between the temperature in the shade and in the sun occurs in early spring. In June, Middendorff was travelling in the Stanowoi Mountains, and saw a rhododendron in full flower; when he was about to gather some flowers of this plant he found not only the roots, but even the stem, frozen hard in the soil. The temperature of the air was between 54° and 43°, but at night it was some degrees below freezing-point.

The assertion of some botanists that the contents of the cells, as soon as they are frozen, make the latter burst, thus causing the death of the plants, has been already refuted by Nägeli; but the important observations of Middendorff have showed clearly that the severest frosts of the Asiatic cold pole, by which the innermost parts of the trees are frozen as hard as iron, have little influence on the tissue when the cold becomes *gradually* more intense; only *when the temperature sinks suddenly below the freezing-point of the mercury* the wood splits with a thundering noise. These crevices have a disadvantageous influence on the vegetation of the tree in summer, because in these places the plant often begins to rot.

The trees rest in a frozen state till, in spring, the sun's rays reach the upper parts, and here vegetation is raised, though the roots and lower parts of the stem are still in a frozen state.

But the most interesting discovery on this subject was made by Middendorff under 69° 30′ N. lat., on April 14, near the village of Dudino; notwithstanding the clear sky and incessant brilliant light of the sun, the temperature at mid-day ranged from −4° to −13°, yet before and after this time from −24° to −35°. While going over the glittering snow he was suddenly stopped by the sight of a willow-catkin peeping about an inch out of it. The catkin was wholly developed, yet the branch on which it was observed was, one or two inches down, solidly frozen; this was also the case with the other parts of the plant hidden under the snow (Middendorff, p. 653). Thus this little part of a branch was called to life, for some hours only, by the direct solar rays, in which it was thawed.

In the beginning of August, under lat. 74° 30′, Middendorff found the soil exposed to the sun's rays heated to 86°, though the temperature about four inches below the surface was only 39°, and at the depth of about one foot the ground was constantly frozen (Middendorff, p. 666).

It is clear that plants in the high northern regions, when they vegetate, receive more warmth by insolation than is often supposed—1° by the direct solar light itself, and 2° by the heated surface of the ground. The snow and ice being melted by the sun, the necessary water and humid atmosphere never fail; even this is the cause of the luxuriant growth of grass on some places of the Tundra. The flowing water gradually communicates its warmth to the soil, and prevents also the nightly radiation.

All this is proof enough that, when the mean temperature in shade is known, this is not at all sufficient for a knowledge of the real temperature by which the vegetation of several plants is raised. What might have been the temperature in the tissue of the little branch and also in that of the willow-catkin, of which we have spoken? and this when the temperature in the shade was so many degrees below freezing-point.

In the temperate regions vegetation commences in spring, when the difference of temperature between night and day is greatest; in the high north this difference is often insignificant, because the sun rests above the horizon; but the temperature of the soil being at this time very much lower than that of the objects exposed to the sun's rays, even this great difference is the cause of the very rapid vegetation in sheltered localities and under the influence of the solar light.[1]

In conclusion we must remark that the facts thus briefly mentioned show how much a new system of bio-meteorological observations is wanted to ascertain the real quantity of warmth and sunlight necessary for the growth of plants, many of which are of the utmost importance in the life of man.

M. BUYSMAN

[1] *Annalen des Physikalischen Central Observatoriums*, St. Petersburg, 1881.

[1] In 50° N. lat., on the banks of the Amur River, where the situation with regard to the ground-ice in spring is the same as in the Taimyr country, *Nasturtium* and *Calamagrostis* plants were observed to grow about half a foot every day (see *Beiträge zur Kenntniss des Russischen Reiches*, Band xxiii. pp. 547, 617).

NEW ORGANIC SPECTRA[2]

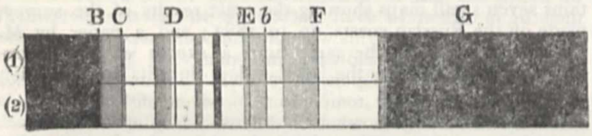
THE absorption-spectra to be described were detected by means of the microspectroscope, and most of them are only fully visible in it, as the dispersion of the chemical spectroscope is too great for the detection of some of the very feeble bands. A binocular microscope provided with a substage achromatic condenser, to which are fitted two diaphragms, was specially made for this kind of work. Its objectives are so adapted as to enable both fields to be fully illuminated when any power up to the one-eighth is used. The left-hand tube is used as a "finder," and as a means of getting any required portion of the object into the centre of the field so that its spectrum may be obtained in the spectrum eyepiece of the right-hand tube. In this way the various portions of a very small bit of tissue or organ may be readily differentiated from each other and

[2] Abstract of a communication made to the Physiological Society, at the meeting on December 13, 1884 (and published in *Proceedings* No. iv. 1884), by Dr. C. A. MacMunn.

their spectra observed. Moreover, by the use of the iris diaphragm, which is placed below the substage condenser, the marginal part of the field can be readily cut off. Another piece of apparatus is indispensable, namely, the *compressorium*, as by its aid the section is squeezed out thin enough to allow the spectrum to be observed.

No reagent whatever is required for the detection of the spectra to be described, so that the substances present cannot be altered in any way.

Myohæmatin.—Physiologists have accepted Kühne's statement that muscle owes its colour to hæmoglobin, but although the majority of voluntary muscles do owe their colour to it, it is accompanied by myohæmatin in most cases, and sometimes entirely replaced by it, while in other cases it entirely replaces myohæmatin. The *heart* muscle of every vertebrate animal which I have examined yields myohæmatin, which gives a very beautifully defined spectrum totally distinct from any decomposition product of hæmoglobin, *e.g.* methæmoglobin, acid or alkaline hæmatin, or hæmatoporphyrin. All one has to do in order to detect myohæmatin is to cut off a bit of heart muscle, put it while fresh in the compressorium, press it down, and observe the spectrum. *No reagent whatever is required.* The spectrum consists of three bands, two of which are very narrow, and persist after the hæmoglobin bands have gone when the tissue has been squeezed out to great thinness in the compressorium. The bands have been missed by other observers simply because when the oxyhæmoglobin bands are well marked they cover and are merged into the myohæmatin bands. The first band of myohæmatin occurs just before D, the next two (of great narrowness) are placed between D and E, and two other faint bands may be present nearer violet, of which the first covers E and *b*, and the other is between *b* and F, close to latter line. Their wave-lengths are: 1st band λ 613–596·5, 2nd band λ 569–563, 3rd band λ 556–549 (heart of dog), and they have been measured in all cases with the same result. I find myohæmatin in the heart muscles and some voluntary muscles of the following



1.—Myohæmatics from Alar muscles of *Vespa vulgaris*. 2.—Myohæmatics from heart of *Limax variegatus*.

mammals:—Man, dog, cat, rabbit, guinea-pig, hedgehog, sheep, ox, pig, rat and hare. In birds: in pigeon, owl, duck, goose, turkey, and fowl. In reptiles: in green lizard, common ringed snake, and fresh-water tortoise. In Batrachians: in toad, frog, salamander, axolotl, and tree-frog. In fishes: in herring, mackerel, tench, roach, eel, plaice, whiting, and codfish.[1] But it is also found in Invertebrates, in which I first detected it. It is found in the muscle from thorax and in leg muscles of the following insect genera:—Dytiscus, Hydrophilus, Lucanus, Cerambyx, Creophilus, Staphylinus, Geotrupes, Carabus, Coccinella, Musca (three species), Tipula, Gryllus, Blatta, Vespa, Apis, Bombus, Pieris, Ennomos, &c. It also occurs in the cephalo-thoracic muscles of spiders, in the heart of the crab, lobster, and crayfish (and not in their voluntary muscles); in the heart and buccal muscles of Arion, Limax, Helix, and other pulmonate mollusks, while in other mollusks it appears to be replaced by hæmoglobin in the pharyngeal muscle, as Prof. Lankester has found out

Two attempts have been made to isolate it. In the first it was got out of the muscle by digesting in pepsine solution, and was slightly changed in the process; in the second it was got out of the frozen heart muscle of a rabbit by pressing out the plasma;[2] here it was mixed with traces of hæmoglobin, but could be differentiated from it: hence it probably occurs in muscle *plasma* like muscle-hæmoglobin.

Histohæmatin.—This name has been given by me to a class of pigments or modifications of the same pigment, which are found widely distributed in the animal kingdom. Myohæmatin belongs to them, as can easily be shown. They are found in Mollusks, Arthropods, Echinoderms, and, modified peculiarly, in Cœlenterates. The bands are carefully measured and compared with spectra yielded by various organs and tissues of Vertebrates, and no difference is found between those of Vertebrates and Invertebrates. In order to see these spectra in the higher animals the blood-vessels are washed out with salt solution thoroughly, and then the organs and tissues examined in the manner described. It is not possible to go into this subject in an abstract, as the facts are too numerous to be compressed into such a small space; it will suffice to say that the histohæmatins are respiratory pigments, as can be proved by oxidising and reducing them in the solid organs. Their bands occupy almost the same place as those of myohæmatin, except that the second and third bands of the myohæmatin spectrum appear compressed into one in some cases.

Myohæmatin itself is also undoubtedly a respiratory substance.

Spectrum of the Supra-renal Bodies.—In the supra-renals of man, cat, dog, guinea-pig, rabbit, ox, sheep, pig, and rat, the medulla gives the spectrum of hæmochromogen, while the cortex shows that of a histohæmatin. Wherever we find hæmochromogen in a vertebrate body it is probably excretory, and I have only found it in the bile and in the liver. Hence, and owing to the remarkable darkness of its bands in the medulla of the adrenals, it must be looked upon here as excretory; if so, the function of the adrenals must be (at least in part) to metamorphose effete hæmoglobin or hæmatin into hæmochromogen; if from disease, or after removal, as in Tizzoni's experiments, the effete pigment is not removed, pigmentation of skin and mucous membrane may take place. The presence of taurocholic acid in the medulla (Vulpian), the resemblance in the structure of the adrenals to that of the liver, and the large lymphatics, with the well-known results of disease of the adrenals in Addison's disease, all go to show that an active metabolic process is taking place in them, and I believe I am justified in concluding that they have a large share in the downward metamorphosis of effete colouring matter, and that these observations will help to throw some light on Addison's disease.

[1] These being all the vertebrate animals which I have yet examined.

[2] After suitable precautions had been taken to exclude the influence of the blood, as fully described in the demonstration.

SOUTH GEORGIA

SOME interesting particulars of the geography, climate, &c., of the island of South Georgia have recently been published by the members of the German Expedition which sojourned in 1883 at the island. They are of the more interest as no scientific expedition had previously visited the island, of which but little therefore is known. The Expedition, in command of Dr. Schrader, took up their quarters at Moltke Hafen, in Royal Bay, which is from four and a half to five miles wide and from six to eight miles long; here observations were made from September 15, 1882, until September 3, 1883, when the Expedition left in a German gunboat. The 8472 observations made during this period on the temperature, air-pressure, moisture, wind, &c., are of great importance.

The island is by its position (54° 31′ S. lat. and 36° 5′ W. long.) not an Antarctic island in the strict sense of the word, but its appearance stamps it as such—Royal Bay being surrounded by mountains, with enormous glaciers from 900 to 1200 feet in height, which further inland rise to 6000 or 7000 feet. This circumstance may give some idea of the climate, and it is therefore not surprising to learn that the mean temperature of the whole period of observation was only 35° F.; for February, the warmest month, 42°, and for the coldest (June) 26°·6. No single month was free from frost, and 30 per cent. of the hours of observation showed a temperature below freezing-point. In July the minimum-thermometer registered 26°·2, and in February the maximum-thermometer 57°·2, the range of temperature amounting to 31°. Clear days occurred in the winter only, the total number being 8; whereas the total of cloudy days was 127; the latter were less frequent in July and August. During December not a single day was clear, and the total number of hours of clear sky was only 269, against 3302 which were cloudy, viz. 38·9 per cent. of the total. Consequently there was much rain and snow, particularly in November and December, which had only one dry day each. Most snow fell in March and least in May. Even the warmest month, February, had 13 days with snow, while the coldest, June, had four days with rain. It hailed on 19 days, principally in December; there were 75 days of fog, but it did not last long. As regards winds and storms, the observations of the Expedition seem to indicate that the neighbourhood of Cape Horn is not quite so stormy as is generally believed. At South Georgia there were many days of perfect calm; the summer was, however, more stormy than the winter. The winds came chiefly from the west—those from a due westerly direction being most common—and also from west-south-west or north-west. The westerly and south-westerly winds were during the winter the warmest, which is ascribed to the circumstance that they passed over mountains some 6000 feet in height, which rendered them "Föhn-like." The barometer readings were never attended by violent storms; these occurred without exception when the glass stood at "fair." There was no aurora australis, nor were there any thunderstorms.

Explorations of the island were undertaken on several occasions, and many of the peaks in the neighbourhood of Royal Bay were climbed. The slate rocks were very difficult of ascent. The enormous glaciers in the mountains of the interior prevented, unfortunately, any thorough exploration of this part. The mountains often sloped abruptly into the sea, and the highest points were about ten miles from the station and covered with eternal snow. The roar of avalanches was continually heard. The fauna was very poor. That such a dreary climate should boast of a very extensive fauna or flora was hardly to be expected; nevertheless, the mosses were very fine. Dr. H. Will, the botanist, collected about thirty varieties. They show what a climate where the sun is nearly always absent can produce in the way of plants which are able to resist rapid changes of temperature, but the fauna is one which may at once be said to belong to more Antarctic regions than Terra del Fuego, the Kerguelen Islands, and more northerly places. It is a repetition of the same types, with originality in details alone.

CARTOGRAPHICAL WORK IN RUSSIA

WE learn from a recent issue of the *Izvestia* of the Russian Geographical Society that the following geodetical and cartographical work was done during the year 1883 by the officers of the Russian General Staff. The first-class triangulation for connecting the line of Warsaw and Grodno with that of the Vistula was continued; the secondary network of triangulation was extended in Lithuania and Poland; and the heights of 262 places were determined by careful levellings. The most useful work of exact levellings on the Russian railways, undertaken several years since, was continued in West and South-West Russia, leading to a precise measurement of the differences of level between the Baltic and the Black Seas, and the final results are now being calculated. The Russian survey was continued on the scales of 1400 and 1750 feet to an inch, in Poland, Lithuania, Bessarabia, and Finland; and a most welcome feature of it is that great attention was given to the measurements of heights, so that a map with level-lines only, 35 to 70 feet apart from one another, may be published. In the Caucasus very accurate measurements of the latitudes and longitudes of Tiflis, Baku, and Shemakla were made, as also pendulum observations in Trans-Caucasia. Of trigonometrical measurements, the triangulation of the Trans-Caspian region was continued as far as the Persian frontier, and that of Akhal-Tekke, was also calculated. An interesting feature of this last was the measurement of two geodetical bases on strings—which method gives, as is known, very satisfactory results—together with a much greater economy of time. Detailed surveys were continued in several parts of the Caucasus, those at Askabad, and between Kyzil-Arvat, Bami, and the Sumbar River (two versts to an inch) being especially worthy of notice.

In Turkestan, at the Tashkend Observatory, Col. Pomerantseff continued his observations of minor planets with the refractor of the Observatory, and the measurement of stars by means of the meridian-circle; and his assistant, Capt. Zalessky, regularly made measurements of occultations of stars by the moon. The work of the Observatory will soon be published, and will contain an elaborate paper by Dr. Schwartz, on magnetism in Turkestan. Several most valuable determinations of latitudes and longitudes were made by M. Putyata in the Pamir during M. Ivanoff's expedition. Among many surveys which were made this year, that of the northern slope of the Turkestan ridge was especially interesting, no less than twenty-three unknown glaciers having been discovered at the sources of the Sokh, and mapped. The Shemanovsky glacier, eight miles long, and that of Ak-terek, twenty-two miles long, which joins the well-known Zarafshan glacier, are especially worthy of notice. A survey of the rich oasis of Karshi, and of the Bokhara dominions on the right bank of the Zarafshan, is also very interesting. The map of Turkestan on the scale of ten versts (seven miles) to an inch, is already in print, and several sheets are nearly ready.

In the Omsk military district we notice several determinations of latitudes and longitudes, as also the survey of the Kirghiz Steppe, on a scale of five versts to an inch. In Eastern Siberia the chief work was the further extension of the triangulation of Trans-Baikalia—a most necessary work, on account of the scarcity of determined points to fix the surveys in that region—and many local surveys, those in the Ussuri region and on the Pacific coast being especially interesting. The astronomically determined points, very few on the whole, have received only seven additions.

The Hydrographical Department has pursued its work on the Baltic, the Black, and the Caspian Seas, as also on some lakes in the interior of Russia and Finland; the most interesting of them being several detailed maps of the Lake of Onega, and the Lakes Päyänne and Pielis, in Finland; the triangulation and surveys on the Caucasian coast of the Black Sea; and the survey of the Gulf Mortvyi Kultuk of the Caspian.

Among the publications of the General Staff we notice the thirty-ninth volume of its *Memoirs*, which contains the following papers:—On the triangulation of Bessarabia, by Col. Lebedeff; on the difference between the longitudes of Tashkend and Vernyi, by Col. Pomerantseff; on astronomical determinations made in Trans-Baikalia (fifty-two places), by Capt. Polanovsky; in the Altay region and in West Siberia (thirteen places), by Col. Miroshnitchenko; in the Trans-Caspian region (with a map), by Col. Gladysheff; and in North-West Mongolia, by Lieut. Rafailoff; on levellings on Russian railways; on the determination of time by means of the meridian-circle, by M. Gladysheff; on the Trans-Caspian triangulation (ninety-two places), by Capt. Pervas, in which it is stated that Askabad is 827 feet, and Mount Riza, on the Persian frontier, 9741 feet, above the sea-level; and finally, a description by Col. Alexandroff of the route from Kungrad to the Gulf of Mortvyi Kultuk, the distance being 300 miles, of which about 90 miles are without water.

The Annual Report of the Hydrographical Department contains seven small maps showing the exact results of the surveys made on the Russian coasts up to 1882; and a paper by M. Goloviznin gives at the same time a sketch of the hydrographical work done by the Russian fleet since its first formation in 1696.

SCIENTIFIC SERIALS

IN the *Journal of Botany* for January Mr. H. N. Ridley describes and figures the extremely rare *Juncus tenuis*, a plant entirely lost to Britain since 1795 or 1796, when it was gathered by G. Don in Clova, till 1883, when it was rediscovered by Mr. Towndrow in Herefordshire. Mr. W. H. Beeby records another interesting addition to the British flora in a new *Sparganium*, which he names *S. neglectum*, nearly allied to *S. ramosum*, and probably a sub-species of it, found in ponds in several parts of Surrey.

THE last part of the *Belgique Horticole* that has reached us, that for May and June 1884, contains but little that is original, the substantial articles being taken from French, German, or English journals. The coloured plates of new or little-known plants, with accompanying descriptions, are of their usual excellence, and there are many short paragraphs of interest to horticulturists.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, January 29.—"On some Physical Properties of Ice and on the Motion of Glaciers, with special reference to the late Canon Moseley's Objections to Gravitation Theories." By Coutts Trotter, M.A., Fellow of Trinity College, Cambridge. Communicated by Prof. Stokes, Sec. R.S.

Canon Moseley's theory of glacier motion, put forward in 1855, has never been accepted by persons conversant with glaciers. In 1869, however, he put forward a somewhat formidable objection to the current gravitation theories of glacier motion.

The gist of the objection is that the resistance of ice to shearing is many times greater than the shearing force which can be produced in a descending glacier by gravity; and that therefore the shearing which the measurements of Forbes and others have shown to be an essential part of the motion of a glacier cannot be produced by gravity alone.

It was pointed out at the time that in Moseley's experiments on the shearing strength of ice the element of time had been disregarded, and a number of experiments have been since published, chiefly on the bending of pieces of ice under the influence of their own weight, which showed conclusively that the continuous action for a considerable time of comparatively small forces will produce effects upon ice which the same forces are quite incapable of producing in a short time. The nature and conditions of the motion were, however, very different from those which we meet with in a glacier.

Under these circumstances it seemed desirable that fresh direct experiments on the shearing strength of ice should be made under conditions differing as little as might be from those under which ice actually shears in the interior of a glacier, and it occurred to me that such experiments might be advantageously made in one of the artificial grottoes which are now excavated year after year for the benefit of tourists in several of the more accessible Swiss glaciers. It seemed that it would be possible in this way to carry out experiments upon glacier ice at a nearly uniform temperature of about 0° C., and under conditions as nearly resembling those of the interior of a glacier as we can hope to attain to in experiments on hand specimens of ice.

I accordingly spent part of the long vacation of 1883 at Grindelwald, and made a series of experiments in the grotto on the right bank of the lower glacier, in order to see whether I could obtain direct evidence of shearing under the influence of forces comparable with those which Canon Moseley admits to be capable of being produced by the action of gravity in a moving glacier.

The experiments are fully described in the paper. Bars of ice were passed through holes in three parallel blocks of wood, nearly in contact with one another. The two outer blocks were hung to a frame and a weight was suspended from the middle one. After the whole had hung for some days, the apparatus was taken to pieces and the shear measured. In a final experiment a shear of about ·075 cm. was observed after the action for about seventeen days of a shearing force of rather more than 200 grm. per square centimetre.

The shearing force employed was indeed rather more than double that which, according to Canon Moseley's calculations, is exerted by gravity in the Mer de Glace, near the Tacul (*Phil. Mag.* xxxvii. p. 369); but it is aboat 1/25th of his smallest value of the shearing strength of ice, and the amount of shear is larger than is implied in any of the ordinary cases of glacier motion.

I think then that there is little doubt that under conditions closely resembling those of the interior of a glacier, and under the influence of forces comparable with those which gravity is capable of exerting in a glacier, hand specimens of ice shear in the same manner as a truly viscous solid would do.

Reasons are given for supposing that the range of temperature through which ice is sensibly viscous is small; the temperature of the interior of a glacier is discussed, and it is pointed out that the position of the "Bergschrund" so familiar in Alpine literature corresponds to a point where there is a change in the temperature of the lower part of the glacier, all below the "Bergschrund" being soft and viscous, all above it hard frozen and immovable.

The general result of the foregoing paper seems to be that the fuller consideration of the physical properties of glacier ice leads to essentially the same conclusions as those to which Forbes was led forty years ago by the study of the larger phenomena of glacier motion—that is, that the motion is that of a slightly viscous mass partly sliding upon its bed, partly shearing upon itself under the influence of gravity. To say this is, however, by no means to deny the importance of regelation in the economy of a glacier. To regelation mainly we must attribute the gradual passage of snow through the form of *névé* into ice, the healing of crevasses, and the possibility of comparatively rapid and violent changes of form in portions of a glacier in which unusually powerful forces may be supposed to be at work. Moseley's argument, however, seems to be decisive againstt the belief that the ordinary comparatively undisturbed descent of a glacier along a moderately sloping bed takes place by fracture and regelation. Moseley's value of the shearing strength of ice, which has been shown to be enormously too great as a measure of the resistance of ice to slow shearing, would appear on the other hand to be an inferior limit to the resistance to the shearing fracture which must precede regelation.

Royal Society, January 29.—"On the Structure and Rhythm of the Heart in Fishes, with especial reference to the Heart of the Eel." By J. A. McWilliam, M.D., Demonstrator of Physiology in University College, London. (From the Physiological Laboratory, University College.) Presented by E. A. Schafer, F.R.S.

The eel's heart presents some peculiarities in structure. The auricle and ventricle are separated by a canalis auricularis. The ventral wall of the sinus venosus does not end in the proper auricular tissue but passes on to be attached directly to the ventricle. The superficial part of the ventricular wall is supplied by a special system of blood-vessels.

When the ventricle is faradised, it is found that a slowly-interrupted current (*e.g.* 3 per second) has a much more powerfully stimulating effect than a rapidly-interrupted current (*e.g.* 50 per second) of precisely the same strength.

The inhibitory effects of stimulation of the vagus nerve-trunk are very powerful; the accelerating after-effects are slight and variable. Vagus stimulation exerts no *direct* influence on the ventricle; it profoundly affects the auricle and sinus. It temporarily abolishes the excitability of the auricular muscle and of the muscular tissue entering into the composition of the ostial part of the sinus.

The manner in which the heart's action recommences after vagal inhibition is peculiar; the interjugular part of the sinus and the ventricle beat before the auricle and the ostial part ot the sinus begin.

The passage of a weak interrupted current through any part of the auricle causes that part to stand still while the rest of the auricle goes on beating. Curara obviates the occurrence of this localised inhibition.

Physical Society, January 24.—Prof. Guthrie, President, in the chair.—Messrs. J. Rose Innes, A. Howard, and A. M. Worthington were elected members of the Society.—Some lecture experiments on spectrum analysis were shown by Mr. E. Clemenshaw. The chief point in these experiments was the production of a brilliant light without the use of the electric arc. A small quantity of a solution of the salt to be experimented on is put into a flask in which hydrogen is being evolved by the action of zinc upon dilute sulphuric or hydrochloric acid; the bottle is provided with three necks, one being fitted with an acid funnel, one with a jet, and by the other is introduced a current of coal-gas, or better, of hydrogen, by which the size of the flame can be increased and regulated. The jet, which is about one-eighth of an inch diameter, is surrounded by a larger tube, by which oxygen is admitted to the flame, the result being a brilliant light giving the spectrum of the substance, which is carried over mechanically by evolved hydrogen. The spectra of sodium, lithium, and strontium were shown upon the screen, and the absorption of the sodium light by a Bunsen flame containing sodium was clearly seen.—An instrument to illustrate the conditions of equilibrium of three forces acting at a point was exhibited by Mr. Walter Baily. This instrument consists of a circular disk of soft wood from the back of which an axle projects. The disk is provided with a graduated circle, and its centre marked by the intersection of two fine lines upon a small mirror. Three compound threads, each consisting of two threads connected by a short piece of elastic, are knotted together, the free end of each being fastened to a pin. Two of these pins are stuck into the disk at such a distance from the centre that the knotted ends cannot reach the centre without stretching each thread, and the remaining pin is then adjusted so that this condition is fulfilled. There are now three forces in equilibrium acting at the knot. The angles between their directions are obtained from the readings of the graduated circle where it is crossed by the threads. To determine the magnitude of these forces, the axle of the disk is held horizontally and turned till a thread is vertical; the pin is then removed, a scale-pan attached to the end of the thread, and weights added till the knot is brought back to the centre. This is repeated with the other threads. It was found possible to show the proportionality of the forces to the sines of the opposite angles with an error not exceeding 1 per cent.—Mr. C. H. Hinton read a paper on the "Poiograph." As the result of a process of metaphysical reasoning, Mr. Hinton has come to the conclusion that relations holding about "number" should be extended to space. Starting from the premiss that the relation of a number to a number is a number, *e.g.* the "relation" of 6 to 2 is 3, the author proceeds to carry these principles into the consideration of space, and concludes that, when properly understood, the relation of a shape to a shape is a shape, and that of a space to a space is a space. The shape that shows the relation of a shape to a shape is called a "poiograph." To form a poiograph the content of each shape is neglected, and the shape is represented by a point, each point being by its coordinates representative of the properties of the shape considered. The resultant shape is a "poiograph."

Anthropological Institute, January 27.—Anniversary meeting.—The retiring President, Prof. Flower, LL.D., F.R.S., in his anniversary address, gave an outline of the classification of the varieties of the human species which appeared to him to be most in accordance with the present state of knowledge on the subject, but which, he remarked, differed in its main outlines but little from that adopted by Cuvier sixty years ago. It was first stated that there were three extreme types, those called by Blumenbach Ethiopian, Mongolian, and Caucasian, around which all existing individuals of the species could be ranged, but between which every possible intermediate form could be found. The distinctive characters of each of these extreme types were described and their subdivisions pointed out. The Ethiopian or Negro branch was divided into (1) African Negroes; (2) Hottentots and Bushmen; (3) Oceanic Negroes or Melanesians; (4) Negritos, of which the natives of the Andaman Islands are representatives. It was suggested that the Australians, who have always presented a difficulty in classification of the races of men, owing to the combination of negroid characters of face and skeleton, with hair of a different type from that of the rest of the group, were probably not a pure race, but descendants of a cross between an original Melanesian population and later intruders, probably from the South of India, and of Caucasian descent. The Mongolian type was represented in an exaggerated form by the Eskimo, in a typical condition by the greater number of the inhabitants of Northern and Eastern Asia, the Tartars, Chinese, Japanese, &c., and in a modified or sub-typical form by the Malays. The brown Polynesians were still further modifications of the same type, greatly mixed with Melanesian and possibly also Caucasian blood. The position of the native races of America was next discussed. Excluding the Eskimo, they all form one group, which, although inclining on the whole nearer to the Mongolian than any of the three great types, had so many special features that it might be looked upon as forming a fourth primary division. The Caucasian, or white branch, includes two sub-races now much mingled together, the Xanthochroi, with fair hair and eyes, and the Melanochroi, with dark hair, eyes, and complexion. To the former belong the inhabitants of Northern Europe, to the latter chiefly those of Southern Europe, Northern Africa (greatly mixed in varied proportions along their frontier line with Negroes), and South-West Asia, the principal sub-divisions being the Aryans, Semites, and Hamites. The address concluded by a reference to two members of the Council lately deceased, Dr. Allen Thomson and Mr. Alfred Tylor; to the change of locality of the meetings which had taken place during the year from St. Martin's Place to Hanover Square, and to other matters relating to the affairs of the Institute. The election of W. Pengelly, F.R.S., was announced. The following gentlemen were elected officers and Council for the year 1885:—President: Francis Galton, M.A., F.R.S.; Vice-Presidents: Hyde Clarke, John Evans, F.R.S., Prof. W. H. Flower, F.R.S., Lieut.-Col. H. H. Godwin-Austen, F.R.S., Major-Gen. Pitt-Rivers, F.R.S., E. B. Tylor, F.R.S.; Director: F. W. Rudler, F.G.S.; Treasurer: F. G. H. Price, F.S.A.; Council: S. E. B. Bouverie-Pusey, E. W. Brabrook, F.S.A., C. H. E. Carmichael, M.A., W. L. Distant, A. W. Franks, F.R.S., J. G. Garson, M.D., Prof. Huxley, F.R.S., Prof. A. H. Keane, B.A., A. L. Lewis, Sir J. Lubbock, Bart., M.P., R. Biddulph Martin, M.P., Prof. A. Macalister, F.R.S., J. E. Price, F.S.A., Charles H. Read, F.S.A., Charles Roberts, F.R.C,S., Lord Arthur Russell, M.P., W. G. Smith, F.L.S., Prof. G. D. Thane, C. Staniland Wake, M. J. Walhouse, F.R.A.S.—It was announced that at the next meeting of the Institute, on February 10, a paper would be read by Mr. H. H. Johnston, on the tribes of East Equatorial Africa.

Entomological Society, January 21.—Anniverary Meeting.—J. W. Dunning, M.A., F.L.S., President, in the chair.—An abstract of the Treasurer's accounts was read by Mr. H. T. Stainton, F.R.S. (one of the Auditors); and the Secretary read the Report of the Council.—The following gentlemen were then elected as the Council for 1885:—President: R. McLachlan F.R.S.; Treasurer: E. Saunders, F.L.S.; Secretaries: E. A' Fitch, F.L.S., and W. F. Kirby; Librarian: F. Grut, F.L.S.; other Members of Council: T. R. Billups, J. W. Dunning, R. Meldola, J. W. Slater, H. Druce, H. Goss, S. Stevens, and J. Jenner Weir.—The retiring President then delivered an address, and a vote of thanks was moved to him by Mr. Stainton and seconded by Mr. J. W. May, and Mr. Dunning replied.—A vote of thanks to the officers was then moved by Mr. McLachlan and seconded by Mr. Waterhouse, and Messrs. Saunders, Fitch, Kirby, and Grut replied.

Victoria Institute, February 2.—A paper on the origin of savage nations by degradation was read by Mr. F. A. Allen, in which he said he only desired to suggest that this was not an unreasonable assumption, and he proceeded to show that traces of a high degree of civilisation either recorded by history or tradition existed amongst many of those peoples which were now generally regarded as savages.

Edinburgh

Royal Society, January 19.—A. Forbes Irvine, Vice-President, in the chair.—Mr. J. B. Readman gave a paper on the ores of nickel and cobalt of New Caledonia. These ores have only recently been identified, although they are met with in great abundance.—Prof. Tait called attention to the expressions used by Newton in the scholium to his "Laws of Motion" when speaking of Mariotte, as contrasted with the expressions he used when speaking of Wren and Huyghens.—Prof. R. Smith communicated a paper on the graphic analysis of the kinematics of rigid-bar mechanisms.—Prof. Tait gave a communication on the necessity for a condensation nucleus. This involves a modification of Prof. J. Thomson's hypothetical form of the isothermals of a true vapour. In the modified form the isothermal shows at once the necessity for the condensation nucleus.

Royal Physical Society, January 21.—John A. Harvie-Brown, F.R.S.E., F.Z.S., &c., President, in the chair.—The following communications were read:—On the ova and the ovary of Echidna, by F. E. Beddard, M.A.Oxon, F.R.S.E., F.Z.S.—Investigations on the movements and food of the herring, with additions to the marine fauna of the Shetland Islands, by Fred. G. Pearcey.—Notes on the birds of the Island of Eigg, by William Evans, F.R.S.E.—Mr. B. W. Peach, F.R.S.E., &c., read a paper by Mr. Robert Ridston, F.G.S., on impressions of rain-drops, recent and fossil, with exhibition of specimens.—Mr. J. A. Harvie-Brown, F.Z.S., &c., exhibited, with remarks, a specimen of *Larus Kumlieni*, from Cumberland Inlet; also of *Larus Sabini*, and other species of arctic gulls.

Dublin

Royal Society, December 15, 1884.—Section of Physical and Experimental Science.—Dr. W. Frazer in the chair.—On a photometer made of paraffin, by J. Joly, B.E. If a prism be cut from a translucent substance, such as paraffin, and so exposed to a source of light that only one of its faces is illuminated, the light diffused through the substance and reflected out through the unilluminated faces of the prism gives it an appearance as if lighted up internally. Two such prisms laid together on smooth faces and receiving light from separate sources (placed so as to be at opposite sides of the plane of division) have the appearance of two luminous bodies laid side by side. When the quantity of light received by each prism is the same, the effect is as if the whole substance was uniformly self-luminous; and if, further, the light from each source is similar in colour, it is difficult to detect the presence of a divisional plane. The prisms are so cut as to lie symmetrically about the plane of contact, and shifted between the sources of light till the trace of the plane of division vanishes. From the close juxtaposition of the surfaces under comparison, the arrangement is a sensitive one.—On artificially-produced gold crystals, by William N. Allen. A neutral solution of chloride of gold and sodium deposited in the course of a few hours lamellæ of metallic gold, which, on examination, proved to be perfectly-formed crystals similar to the native forms figured in Muspratt's chemistry. The largest observed crystal was 3/1000 inch in diameter.—Recent advances in physical science, by Prof. G. F. Fitz Gerald, F.R.S.:—(1) The transference of energy in the electro-magnetic field (Prof. Poynting); (2) The motion of an electrified sphere (J. J. Thompson).—Note on a remarkable belt seen on Saturn on December 6 and on this evening (15th), by G. Johnstone Stoney, D.Sc., F.R.S. The belt consisted of a thin dark line, almost black, above the ring, *i.e.* south of it, with a broad, shaded, bright band between it and the ring, which was so shaded as to give the appearance of a swelling round the equatorial part of the planet.—On the results of analyses of milk, cream, and butter at a recent dairy show, by R. J. Moss, F.C.S. Cream obtained by the separator was found to be very much richer in "solids, not fat," than cream obtained by the ordinary process of skimming. Butter made by different dairy-maids from the same cream and under identical conditions was found to vary chiefly in casein. The minimum quantity of casein found in this butter was 0·32 per cent., the maximum 1·17 per cent. It was observed that the specimens that received the highest awards from the judges were those that contained most casein.—A new form of ammonium chloride inhaler was exhibited by A. M. Vereker.

Natural Science Section.—On *Peachia hastata* (Gosse). Part i., description and habits, by Prof. A. C. Haddon and G. Y. Dixon. A description of the form, colour, and markings, and the variations of the conchula of specimens recently found in Dublin Bay, and an account of its habits supplementing that of Gosse.—Canadian, Archæan, or pre-Cambrian rocks, with a comparison with some of the Irish metamorphic rocks, by G. H. Kinahan, M.R.I.A.—Notes on apatite from Buckingham, Ottawa Co., Canada, by G. H. Kinahan, M.R.I.A.—A set of musical stones from Cumberland, now in the Science and Art Museum, were exhibited and described by B. H. Mullen. Specimens showing the mode of occurrence of *Sclerotium varium*, Berkeley, were exhibited by T. Carroll.—The communication on *Halcampa Andresii*, November 17, was by Prof. A. C. Haddon.

Sydney

Royal Society of New South Wales, December 3, 1884.—H. C. Russell, B.A., President, in the chair.—Sir George Biddell Airy, K.C.B., F.R.S., &c., and Prof. John Tyndall, D.C.L., F.R.S., &c., were elected Honorary Members; three new ordinary Members were also elected.—The Society's medal and 25*l.* were awarded to Mr. W. E. Abbott, of Wyngen, for his essay upon "Water Supply in the Interior of New South Wales." None of the papers upon "Origin and Mode of Occurrence of Gold-bearing Veins and of the associated Minerals," or "On the Infusoria peculiar to Australia," were considered of sufficient merit to be awarded the prize. No communication was received upon "Influence of the Australian Climate in producing Modifications of Diseases."—The following papers were read:—Notes on Doryanthus, by C. Moore, F.L.S., illustrated by specimens of a new species.—Notes upon a new self-registering anemometer, by H. C. Russell, B.A., F.R.A.S.—Water-supply in the interior of New South Wales, by W. E. Abbott.—Mr. C. S. Wilkinson, F.G.S., exhibited some experiments to illustrate the nature of comets and to explain the reason for the tail being usually turned from the sun.

December 17, 1884.—H. C. Russell, B.A., President, in the chair.—Mr. Caldwell exhibited specimens illustrating his researches into the embryology of the Marsupiala, Monotremata, and Ceratodus.

Paris

Academy of Sciences, January 26.—M. Bouley, President, in the chair.—On the limit of accuracy in the differential formulas employed in the reduction of meridian observations, by M. M. Lœwy.—On the chemical neutrality of the salts, and on the use of colouring substances in the quantitative analysis of the acids, by M. Berthelot. In the present paper the author proposes to generalise the results already obtained in the use of several new colouring substances endowed with special properties of late years introduced into the process of chemical analysis. He gives the thermic interpretation of the effects distinguishing these substances, which are acids and salts whose proper reactions are determined by the laws of saline statics.—Note on the pyro-electricity of the topaz, by MM. C. Friedel and J. Curie. From their experiments the authors conclude that the crystals of topaz possess not only the already determined pyro-electric vertical axis parallel to the axis of the prism, but also a horizontal axis of pyro-electricity present at least in some specimens examined by them. But, owing to the limited number of these specimens, it is impossible clearly to define the position of the horizontal axis. The intensity of the electricity developed varies with the specimens themselves, in some of which the two extremities of the axis are of like sign, which may be explained by the existence of superimposed hemitropic lamels.—Note on the modifications produced in the chemical composition of certain secretions under the influence of epidemic cholera, by M. Gabriel Pouchet.—On the development of the egg of *Phylloxera punctata*, which infests the *Quercus sessiflora*, by M. V. Lemoine.—Chief results of the examination made at Toulouse during the years 1876-1883 of the observations of Saturn's satellites, by M. B. Baillaud.—Discussion of the results obtained with the Daguerrotype pictures of the French Commission appointed to observe the Passage of Venus in 1874, by M. Obrecht. The author concludes that the parallax of the sun, as deduced from the observations made by MM. Baille and Gariel, is found to vary between 8″·77 and 8″·33. This coincides with the 8″·66 with a probable error of 0″·06 already obtained by M. Bouquet de la Goye from the same data.—Results of the observations of the solar spots and faculæ made during the last quarter of the year 1884, by M. Tacchini. The results for the whole year, as compared with 1883, show that the period of greatest solar activity comprised the eight months from October, 1883, to May, 1884.—On a class of partially derived equations of the first order, by M. E. Picard.—On a special case of reduction in linear equations of the fourth order, by M. E. Goursat.—On the forms capable of integration in linear equations of the second order, by M. R. Liouville.—On the phenomena of condensation which take place in steam-engines during the period of admission, by M. F. Delafond.—Remarks on the dangers incidental to mechanical generators of electricity, and on the best means of avoiding them, by M. A. d'Arsonval.—On the ammoniacal sulphates of zinc, and on a means of separating a purely aqueous solution into two distinct layers, by M. G. André.—On the heat of formation of the sulphite and bisulphite of ammoniac, by M. de Forcrand.—Remarks on the cardiac hypertrophy occurring during the period of growth, usually between the years eight and twenty-one, by M. Germain Sée.—On the differential morphological characters of the young colonies of comma-bacillus cultivated in gelatine, by MM. Nicati and Rietsch.—Analysis of a chrysostile (a fibrous serpentine presenting the appearance of asbestos); a silica resulting from the action of acids on serpentine rocks, by M. A. Terriel.—Note on the geological phenomena produced by the earthquakes that took place in Andalusia from December 25, 1884, to January 16, 1885, by M. A. F. Noguès. A description is given of the crevasses, landslips, upheavals, subsidences, and other remarkable phenomena accompanying these disturbances.—M. Prestwich was elected a member for the Section of Mineralogy in the place of the late Signor Sella.

Berlin

Meteorological Society, January 6.—Prof. Müttrich gave a short historical review of the arrangements in connection with forest meteorological stations in Prussia, seventeen of which were in operation. They were established on as uniform a system as possible over regions of very wide varieties of climate: on plains and at different levels above the sea, in districts having a more continental, and in districts having a more oceanic, climate, and in leaf and pine forests. In all these places, moreover, observations were made according to precisely the same regulations. Each station was twofold, having one equipment in the wood, another in the open field; both, as a rule, at a distance of 200 metres from the edge of the wood. The observations comprised the atmospheric pressure, the temperature of the air and of the ground, the wind, moisture, cloudiness, atmospheric precipitation, and the evaporation of an open mass of water. These observations were made twice a day—at 8 a.m. and 2 p.m. The observations thus obtained were collected at the station of Eberswalde, and published regularly in monthly and yearly reports. From the body of observations made at thirteen stations in operation since 1873, Prof. Müttrich had now made a more special investigation into the influence of the forest on temperature. In order to obtain data to serve as a basis for determining the influence exercised by the forests on the daily march of the temperature, he had caused observations to be instituted in Eberswalde every two hours throughout a period of fourteen days from June 15 to 30. The graphical representation of these observations showed that the curve of temperature for the field station, starting from the point reached at midnight, sank a little at first, then rose at a quick, but later on at a somewhat abated, rate to its maximum at about two o'clock, whence it sank again, rapidly at first, then more slowly, to its midnight level. The curve of temperature for the forest station had, generally speaking, an analogous course. At midnight, however, its curve started at a higher point than that of the field station, crossed the latter at 5 a.m., and afterwards continued to be lower than the field curve, till at 8 p.m. it intersected the field curve for the second time, and thence continued above it till midnight. The difference in the maxima of the two curves was considerably greater than the difference in their minima, that is to say, the wood exercised during the day a more powerful cooling influence than it exerted a warming influence during the night. The maximum of the forest curve, besides, occurred from half an hour to an hour later than that of the field curve. For the further study of the influence of forests on temperature, the data of the maximum and minimum thermometers were utilised. From these were calculated the daily variations of temperature for the different months at the different stations, and the yearly course of these variations for each particular field and forest station was exhibited by a curve, the abscissæ of which were the months and their ordinates the mean daily oscillations of temperature. From the curves of the various stations, special curves for the open field, the fir, pine, and beech forests were next deduced. The curve for the field station showed that the daily variations in January and February were within narrow limits and pretty similar, that in March the curve rose, then mounted very rapidly in spring and up to its summer maximum, whence in September it dropped very rapidly, abating, however, its rate of fall in October, and then creeping down very slowly through November and December. The curve for the fir forest was, in January and February, not much different from the foregoing in the same months, but the variations were smaller than in the case of the field station. The curve next rose rather more steeply on to the month of May, and after that proceeded more slowly towards its summer maximum, from which it fell, at first quickly and then slowly. All along, however, it kept inferior to the curve of the field station, the interval between the two being much greater in summer than in winter. In the pine forest the curve marking the variations of temperature showed a similar course, except that from January to April it approached much nearer the curve of the field station than did the curve of the fir forest, while in summer, on the other hand, it kept at a greater distance from that of the field station, but joined the fir-forest curve in autumn. Thus the curve of the pine forest likewise all along kept below that of the field station. The difference between them was less in winter, and in summer it was almost just as great as the difference between the field curve and the fir-forest curve. Altogether different, however, was the curve of temperature and its variations in the beech forest. In January and February it lay at but a very little interval below that of the field station, came up almost quite level with it in spring, or even shot just a very little beyond it, attained its maximum for the year in May, whence it at first rather slowly, but afterwards very rapidly, declined. In the beech forest, therefore, after it put on its full foliage in May, the variations of temperature lowered considerably, showing a very wide difference throughout the months of July and August from the variations of temperature obtained for the same period in the open field. The disfoliaged forest, on the other hand, showed hardly any sign of having affected the variations of temperature. The maxima, as also the minima, of temperatures were likewise calculated by the month for the different stations, and from the data thus obtained the annual curve was drawn. For the open field the curves of the maximum and of the minimum temperatures showed a pretty similar course, the maximum of both occurring in summer, and the rise and fall of the curves being likewise tolerably uniform. For the forest station the curves of the maximum and of the minimum temperatures were different. The maximum curve lay, on the whole, lower than the corresponding curve of the open field. It moreover attained its utmost height in May, resting there, with but slight changes, throughout the summer. In autumn the curve sank, reaching, in winter, quantities not essentially different from those of the field curve. The curve of minimum temperatures, on the other hand, in the case of the forest station, showed higher values than obtained in the case of the free station. In the pine forest the course of the minimum curve came nearer to that of the field curve, and there, too, a maximum was found in summer. In the beech forest, however, the curve attained its maximum as early as May, keeping that level pretty nearly all through the summer, but sinking more rapidly in autumn, and descending lower than did the curve of the pine-forest station. As a result of his investigation, Prof. Müttrich had arrived at certain definite conclusions respecting the influence of the forest on temperature, which may be stated as follow:—(1) The forest exercised a positive influence on the temperature of the air; (2) the daily variations of temperature were lessened by the forest, and in summer more than in winter; (3) the influence of the leafy forest was in summer greater than that of the pine forest, while in winter the tempering influence of the pine forest preponderated over that of the disfoliaged forest. An attempt to determining the influence of the forest on the mean annual temperature led to no sure results.

STOCKHOLM

Royal Academy of Sciences, January 14.—Prof. Sven Lovén gave an account of the work done last summer at the zoological station of the Academy, and of the special reports thereon by Dr. Carl Aurivillius on Ostracoda, M. Wirén on Annelida, and M. Fristedt on sponges.—Prof. Lovén also gave the results of his studies on the species of echinoids described by Linnæus, the fundamental specimens of which, formerly in the cabinet of Queen Lovisa Ulrica, exist still in part in the Museum of the Upsala University.—Prof. Nordenskjöld spoke on the inland ice of Greenland, and on the mineral dust found on the same.—Prof. Torell exhibited a geological map of the southern part of Sweden, published by the Geological Survey of Sweden, and also a map of the northern part, delineated at the same institution. He also described other geological maps of Sweden.—Prof. Smitt reviewed the travels of Dr. Emil Riebeck in Asia and Africa, and communicated a paper by the Rev. F. Hammargren on the bleating-like sound of the common snipe.—Prof. Wittrock communicated papers (1) by M. Henning, on his travels in Herjeådalen with regard to its mycology; (2) by M. G. Lagerheim, on his algological researches in the province of Bohus; and (3) by M. C. J. Johansson, on Taphrina, Fr., and the Swedish species of that genus.—The Secretary, Prof. Lindhagen, presented the following papers, viz.:—New or imperfectly known Isopoda described by Dr. C. Borvallius; on the action of the dioxide of hydrogen on earths; on the combinations of samarium; and new researches on the combinations of didymium, all by Prof. P. T. Cleve of Upsala.

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