Nature

A WEEKLY

ILLUSTRATED JOURNAL OF SCIENCE

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"*To the solid ground*
Of Nature trusts the mind which builds for aye."—WORDSWORTH

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NATURE

A WEEKLY ILLUSTRATED JOURNAL OF SCIENCE.

"*To the solid ground*
Of Nature trusts the mind which builds for aye."—WORDSWORTH.

THURSDAY, MAY 5, 1887.

LOOMIS'S CONTRIBUTIONS TO METEOROLOGY.

Contributions to Meteorology. By Elias Loomis, LL.D., Professor of Natural Philosophy and Astronomy in Yale College, &c. Revised Edition. Chapter II. (New Haven, Conn., 1887.)

IN Chapter I. of the revised issue of these valuable contributions to meteorology, Prof. Loomis summarised, and in some directions materially extended, the laborious investigations on which he had been engaged for the previous ten years, with reference to areas of low atmospheric pressure—their form, magnitude, direction, and velocity of movement (NATURE, vol. xxxiii. p. 49). In Chapter II. he similarly deals with the allied problems of meteorology which group themselves round areas of high atmospheric pressure, investigates their form, magnitude, direction, and velocity of movement, and concludes by tracing some of the more important relations of areas of high to areas of low atmospheric pressure.

It is premised that areas of high pressure exhibit characteristics quite unlike those which attend areas of low pressure. A typical example, contrasting the two sets of phenomena, is given in the great storm of February 5, 1870, where, in the centre of the Atlantic, pressure fell to 27·33 inches, whilst at the same time, and contiguous to this great cyclone, there occurred a strongly-marked anticyclone in Europe, where, over an extensive region, pressure rose to upwards of 31·00 inches. Near the centre of the cyclone the winds blew with hurricane force, but near the centre of the anticyclone the atmosphere was well-nigh calm. In the cyclone the winds circulated about the low centre in a direction contrary to the hands of a watch, with, at the same time, a decided tendency inwards upon the centre of low pressure; whereas in the anticyclone the winds circulated about the high centre in the same direction as that of the hands of a watch, with a decided tendency outwards from the centre of high pressure.

As regards their form, cyclones nearly always approximate closely to the circular, elliptical, or oval forms; but on the other hand, the departures of anticyclones from the circular form are nearly always quite palpable; indeed, we rarely find an isobar about a centre of high pressure which does not clearly deviate from the figure of an exact circle. The isobars are generally elongated, and are thus elliptical rather than circular, and the elongation is sometimes very great.

In order to ascertain the general form of the isobars of anticyclones, Prof. Loomis has examined and measured with care 238 well-defined cases, shown on the United States weather-maps. The result indicates that the average ratio of the longest to the shortest diameter was 1·91. Whilst the longest diameter may be turned in any direction, 72 per cent. of the cases occurred in the azimuth from 0° to 90°, the direction of maximum frequency being N. 44° E. It is noteworthy that these results intimately agree with those found for low-pressure areas, showing, together with other results, how intimately cyclones and anticyclones are connected.

A similar investigation has been carried through as regards these two great systems of pressure for the Atlantic and Europe. In this part of the inquiry the number of cases examined was 252, which showed that the average ratio of the longest to the shortest diameter was 1·84; and as respects the direction of the longest diameter, 69 per cent. of the cases occurred in azimuth from 40° to 130°, the direction of maximum frequency being N. 75° E. Thus, while there is a remarkable correspondence between the results for these two great regions of the globe as respects the form of anticyclonic isobars, there is not the same accord as to the prevalent direction of the longest diameter. It may be well to emphasise here this vital difference between the anticyclones of North America, and those of the much larger Europasian continent. About three-fourths of these anticyclones occurred during the six colder months of the year.

When an area of high pressure is situated between two areas of low pressure not far apart from each other, the anticyclone generally takes a very elongated form, and sometimes the isobars surrounding this high area extend a distance of several thousand miles, with but little

curvature. The isobars for January 14, 1876, show between one widespread low-pressure area over the North Atlantic and Arctic Oceans, and another over the Mediterranean, a belt of high pressure, with nearly straight and parallel isobars of 30·3 and 30·5 inches, extending from south-west to north-east for about 3000 miles.

With the view of throwing some light on the origin of anticyclones, all those cases in the States in which the barometer rose to 30·85 inches or upwards during the twelve years ending with 1884 were examined. Of such anticyclones there were fifty-two cases, distributed as follows: in October one, November ten, December eight, January fourteen, February sixteen, and March three; the earliest having occurred on October 26, and the latest on March 12. The majority of the whole number of cases occurred north of lat. 46°, only two being south of lat. 40°; and the influence of longitude was equally strongly marked: 82 per cent. of the cases occurred west of long. 90° W., and nearly half of the number west of long. 100° W. These areas of high pressure indicate a general movement towards the south-east, the prevalent direction being S. 40° E. at a mean velocity of twenty-one miles an hour.

An instructive point in the history of anticyclones is the low temperature which accompanies them. It is shown from a somewhat exhaustive examination that, when pressure is unusually high, temperature is generally very much below the mean, and that the amount of the depression increases with the height of the barometer; and it is further shown that with a given barometric pressure the temperature depression is greatest in the neighbourhood of Manitoba, or approximately in the centre of the continent. These relations are sometimes shown on the weather-maps with a surprising closeness, of which an instructive instance is figured on Plate XXV., which gives the isobars and thermic isabnormals for December 24, 1872. In the case of the more strongly pronounced anticyclones, the depression of the temperature below the mean for the season is on the average 38°·7. The maximum temperature depression may occur in any direction from the place of highest pressure, but it is generally about 400 miles distant from it, and most frequently on its northern side. Indeed, in only 12 per cent. of the cases examined did the place of greatest temperature depression correspond exactly with the place of highest pressure. Similar relations exist as regards the summer anticyclones, with the important differences that their maximum pressure is generally about half an inch less than that of winter cyclones, and their temperature depression below the mean of the season only about 8°·0.

The average breadth of the American anticyclones is 2587 miles, which is nearly equal to the breadth of the continent in lat. 40°, and an examination of the maps of the *International Bulletin* show that a large number of high-pressure areas are 4000 miles in length. The average distance from the centre of an anticyclone to the centre of the cyclone on its east side is 2371 miles, and to the centre of the cyclone on its west is 2381 miles, being thus nearly equal. Since, however, the average value of the lowest isobars of the cyclones on the east side is 29·190 inches, and on the west 29·570 inches, it follows that the gradients on the east side of the United States anticyclones are about twice as great as those on the west side. This is an extremely valuable result, as showing the powerful influence of the Atlantic in lowering atmospheric pressure, and thus intensifying storms as they near its seaboard in their course eastwards. Indeed, as regards those cyclones which show a pressure not exceeding 29·00 inches at their centre—in other words, the more important storms—five-sixths of the number occurred near the Atlantic. The cases examined numbered 131, and were distributed through the months as follows, beginning with January: 14, 16, 25; 10, 4, 1; 0, 2, 2; 7, 26, and 24; there having thus occurred 105 during the five months from November to March, and only 5 during the four months from June to September.

It is shown that, while an area of extraordinarily high pressure uniformly has an area of low pressure both on its east and west sides, the barometer in these areas seldom sinks very low, and when it does sink very low the centre of the low pressure is very remote; and on the other hand that an area of very low pressure has an area of high pressure both on its east and west sides, but in these areas of high pressure the barometer seldom rises very high.

As regards anticyclones, Prof. Loomis makes it abundantly clear that the height to which pressure rises in their centres is approximately proportioned to the depression of temperature over the region at the time. In these circumstances, the air, being condensed by the cold, sinks more and more into the lower regions of the atmosphere, thus leaving a less pressure in the upper regions than prevails all round at these heights, and consequently upper currents set in all round towards and upon the anticyclonic region, by which its high pressure is further increased. Hence it follows that it is over one and the same region, viz. the more inland portions of the Europasian continent, where depressions of temperature are greatest, most widespread, and most persistent, and where the best-pronounced anticyclones occur in the colder months of the year. This state of things is entirely due to the great extent of the Old continent, by which a very large portion of it is remote from the disturbing influence of the ocean. The same cause explains a singular feature of the anticyclones of this part of the globe, viz. the absence they frequently show, sometimes for weeks together, of any movement of translation over the earth's surface, being so different in this respect from the anticyclones of the comparatively narrow continent of America, which have a distinctly progressive movement towards the south-east, already referred to.

On the other hand, low pressures are distinguished by the relatively high temperature which accompanies them. The highest temperature occurs about 300 miles on the south or east side of the low centre of the cyclone, the average excess above the mean temperature being 22°·3. No inconsiderable part of the low pressure of cyclones is occasioned by the high temperature and excessive moisture which accompanies them. But, while all, or nearly all, of the high pressure of anticyclones may be accounted for by the very low temperatures which overspread the same region at the same time along with the resulting upper currents concentrating upon them from adjoining cyclonic regions, it is quite different with the low pressures of cyclones. In the case of cyclones the

problem is complicated by the strong winds, the copious precipitation, and the ascending currents, which affect the results in ways which no physicist has yet been able to explain.

The problem of the weather would be immensely simplified if it could be explained, first, how it is that air highly heated and approximately saturated with aqueous vapour comes to overspread a definite well-marked region, usually a very extensive one, while the atmosphere over contiguous regions remains relatively cold and dry; and, secondly, how the low temperature which is so characteristic a feature of anticyclones and of the rear of cyclones has its origin. The complete changes which weather-maps show us to take place in these respects over enormous tracts of the earth's surface within even such brief spaces of time as twenty-four hours, point to volumes and velocities of translation of masses of air through the upper currents which meteorologists have yet scarcely taken cognisance of. Prof. Loomis's paper is a well-worked-out and valuable contribution towards the solution of this all-important practical problem.

THE GAME OF LOGIC.

The Game of Logic. By Lewis Carroll. (London: Macmillan and Co., 1887.)

MR. "LEWIS CARROLL'S" new book has both the merit and the sterility which might be expected from a fresh and rather independent system of diagrammatic or visual logic. That is to say, it is ingenious and closely worked out, but cannot be said to advance either our theoretic knowledge of reasoning processes or the more practical craft of dealing with assertions and arguments as found in ordinary life. Perhaps so trying a standard ought not in fairness to be applied to the work before us, which is intended—so the preface and the title hint—to amuse those who would otherwise play with some less instructive puzzle. But it is because it seems unlikely that "The Game of Logic" will be patiently studied as a game, or would reward such patience by providing "an endless source of amusement," that one is inclined to consider it rather as a contribution to visual logic than to any other form of literature.

Technically speaking, the propositions contemplated are "extensive" and "existential." That is to say, all assertions are supposed to be concerned with things as members of classes, and to be translatable into the form "Of the class $u\,x$ there are none (or 'some') which are $u\,y$"; so that, for example, "I feel much better" becomes (pp. 50, 70, and 9) "Of the class of persons who are I, there are none who do not feel much better, and there are some who do"; and "There is no one in the house but John" becomes "Of the class of persons who are not John, none are in the house." Of course these are here chosen as examples of difficulty in translation: a great many propositions can be much more naturally treated as expressing class-relations.

Every assertion is thus supposed to perform two functions: it provides a certain number of labelled compartments, and it tells us that one or more of these is either empty or "occupied." If, for example, we regard a given proposition as containing only two terms, x and y, the compartments provided are four in number: $x\,y$, x *non-y*, *non-x* y, and *non-x non-y*. (Mr. Lewis Carroll however adopts Mr. Maccoll's neater notation for the negative terms.) And if two such propositions have one term in common—say, if the first speaks of x and m, and the second of y and m—the two can be taken together as one complex assertion providing eight compartments, and giving, under certain conditions, more information about x and y than is to be found in either proposition when taken singly.

As regards the division of the universe into compartments, there is little to distinguish Mr. Lewis Carroll's system from others which, like Boole's or Jevons', make use of a similar framework; and nothing to distinguish it from Mr. Venn's, except the form of picture employed. But the special features consist in (1) making all affirmative propositions assume the real existence of the subject, and (2) providing for the expression of certain forms of proposition which are usually found difficult to put into diagrams. For example, by means of the restricted sense given to the assertion that a compartment is *occupied*, the "particular" proposition, which often causes trouble, becomes easily expressed. In Mr. Venn's scheme, propositions either tell us that a compartment is empty or else tell us nothing about it, whereas here the information that a compartment is *occupied* (meaning merely "not empty") can also be distinctly given; so that to mark the compartment $x\,y$ as "occupied" expresses "some x are y" and "some y are x" together. Again, "some x exist," "no x exist," and "*only* some x are y" are readily and neatly represented; and a distinction, due to the assumption of real existence, is drawn between "all x are y" and "no x are *non-y*," and similarly between "no x are y" and "all x are *non-y*."

The author is in one or two instances not quite fair to the more old-fashioned logicians. It is not the case, as stated on p. 30, that those who regard the universal negative as asserting incompatibility of attributes would therefore regard the assertion "No policemen are eight feet high" as *false*. They might rather be inclined to consider any such *a priori* treatment of it as a case of *petitio principii*, since, if the assertion be supposed to intend giving information at all, the question whether or no the attributes *are* compatible is supposed to be at issue. Again, there are probably few logicians in existence who would simply turn away with scorn from the premises given on p. 35. Even the more pedantic would rather suggest that a very slight verbal alteration performed on the minor premise by recognised processes (conversion and obversion) would give a legitimate syllogism in *celarent*. But no doubt Mr. Lewis Carroll's method deals with such premises more directly.

It is held by some who ought to know, that logic might be taught at a much earlier age than is now the fashion; and possibly the book should be regarded as an attempt to make a beginning in this direction. If so, the advantages and disadvantages of the scheme seem about evenly balanced. Certainly the diagram is simple to draw, full in its information, and easily read; but these good qualities are gained at some expense. The difficulty of forcing all assertions into the forms of class-inclusion is not indeed peculiar to Mr. Lewis Carroll's system; but the assumption of the real existence of the subject leads, in certain cases, to additional troubles of interpretation.

For example, the whole range of hypothetical and abstract assertions would require to undergo some preliminary torture: wherever a sentence intends to assert that one fact conditions another, without expressing an opinion as to the actual fulfilment of the condition, we should have to contraposit the sentence and restrict it to the negative form. Thus "policemen seven feet high would attract a crowd" seems to require reading: "Things that would fail to attract a crowd are not policemen seven feet high"—a form which most children would think unnatural. Indirectly the child might learn, by this system as well as by any other, that the real difficulty of avoiding logical blunders lies more in translating ordinary language into carefully-defined symbols, than in the operations afterwards performed by merely mechanical rules. But teachers who desire rather to show by diagrams the direct binding force of deductive reasoning would do well to select for illustration those propositions which can be most simply and naturally regarded as expressing the "extensive" comparison of classes. It is only fair to Mr. Lewis Carroll to add that the examples he provides for exercise will not perhaps do more to keep alive the notion that logic is trivial than many of those that are given in perfectly sober text-books. As things are, the junior student seems, not unnaturally, to believe that the safest plan of answering logical conundrums is to find out the most ingenious and roundabout way of avoiding the answer that would be dictated by common-sense. It is worth considering whether the correction of this tendency is not a more pressing need in the teaching of elementary logic than even the best new variations on the old surprise of finding that absurdity in matter is no bar to legitimacy in form. ALFRED SIDGWICK.

OUR BOOK SHELF.

Nitrate of Soda: its Importance and Use as a Manure. A Prize Essay. By A. Stutzer, Ph.D., re-written and edited by P. Wagner, Ph.D. (London: Whittaker and Co., 1887.)

IN the spring of 1885 a committee of South American nitrate of soda manufacturers offered a prize for the best popular essay on the above subject. The judges were Profs. Grandeau (France), Adolf Mayer (Holland), Petermann (Belgium), Thoms (Russia), P. Wagner (Germany), and Mr. Warington (England). The prize was divided between two of the competitors, Dr. A. Stutzer, President of the Bonn Agricultural Experiment Station, and Prof. Adolphe Damseaux, of Gembloux.

The book now presented embodies the main points of Dr. Stutzer's essay, combined with the views expressed by the committee of judges, and important matter contained in the second prize essay. The subject is divided into two parts, in the first of which theoretical questions as to the advantages to be derived from the use of nitrate of soda are ably and thoroughly sifted, and the error of many popular prejudices is exposed. The important question of the impoverishment of the soil is carefully discussed, and the conclusion arrived at that it causes an increased consumption of nutrient substances only in proportion to the increase of crop, and does not increase the percentage of potash and phosphoric acid in the crop, and even that a larger crop is produced with proportionally smaller use of the two latter materials. It is also shown that, although nitrate of soda does cause a large increase of straw, yet it quite as certainly causes an increase in the quantity of grain.

The second portion of the book contains very clear instructions for the use of nitrate of soda with various crops, and will prove a capital practical guide for farmers. A. E. T.

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.*]

Units of Weight, Mass, and Force.

IN a letter to NATURE, dated March 29, I stated that we have "no names for units of velocity, acceleration, impulse, momentum, &c." This cannot be said now. Through the kindness of Messrs. Macmillan and Co., I have, this morning, received a copy of "Dynamics for Beginners," by the Rev. J. B. Lock, M.A. In this book the units of velocity and of acceleration are named a velo, and a celo, respectively. Other units also have received names, "the use of which" (as the author justly observes) "will be found to simplify considerably the language of the subject." The preface to this book is dated April 1887.

Bardsea, April 23. EDWARD GEOGHEGAN.

Earthquake in the Western Riviera.

AN interesting fact in connexion with the late disastrous earthquake which did such damage along the Western Riviera of Liguria on the morning of February 23 last, and with which I only lately became acquainted through my friend Dr. Bellotti, of Milan, who was at Nice at the time, is that during the days immediately following the catastrophe quite a large number of deep-sea fish were taken dead or half dead in shallow water or found stranded on the beach. This happened more especially in the immediate neighbourhood of Nice, whose sea, as that of Messina, has long been well-known for its richness in deep-sea fish.

I have since taken the pains to inquire more fully into the subject, which has a very special interest for me, and through Gal frères I have learnt that the following species were taken: *Alepocephalus rostratus* (mostly dead and floating), numerous; *Pomatomus telescopium*, several; *Tetragonurus cuvieri*, one specimen; *Dentex macrophthalmus*, many; *Scopelus elongatus*, several; *Scopelus humboldti*, several; *Spinax niger*, abundant.

Alepocephalus rostratus is a typical deep-sea form, only found as yet, and rarely, during the summer along the Western Riviera by deep-sea liners.

Several of the fish above mentioned are in my possession.

Firenze, April 20. HENRY H. GIGLIOLI.

The Boiling-Point and Pressure.

A VERY convenient lecture experiment to show that the boiling-point of liquids is lowered by diminishing the pressure of the surrounding medium, may be made with one of Ducretet's carbon-dioxide tubes. The lower part of the tube contains the CO_2 in the liquid condition, while the upper part is, of course, filled with the same body in the gaseous state. By subjecting this upper half of the tube to a jet of ether spray, the pressure of the inclosed gas will gradually diminish, and after a few seconds the liquid below will enter into brisk ebullition.

The experiment is readily adaptable for projection on a screen. M. F. O'REILLY.

St. Joseph's College, Clapham.

A Sparrow chasing Pigeons.

MR. J. JENNER WEIR (NATURE, vol. xxxv. p. 584) says that he has never observed a sparrow to chase a pigeon *except when on the wing*. I wish to say that I have frequently witnessed the occurrence, having kept pigeons for a number of years. I have

often seen sparrows chase pigeons on the house-tops, particularly when the former have had their nests in the vicinity. One season, about ten years ago, I well remember the annoyance these impudent birds caused to the pigeons, for whenever the latter were let out in the morning to air themselves the sparrows would immediately attack them and continue the harassment without intermission all day long. On one occasion, during the same year, I recollect a very amusing scene between a cock sparrow and a cock tumbler pigeon. The former had just flown on to the house-top with a large piece of bread in his bill, when the pigeon advanced rapidly towards him with the intention of seizing the dainty morsel. The plucky sparrow, however, was in readiness for him, and dropping the bread he made a bold onslaught on his larger feathered relation, pecking vigorously at his rear quarters. The pigeon not expecting an attack from such an insignificant foe, and being utterly unprepared for a "round," did not attempt to use its wings as weapons, as is its custom, but contented itself with cooing, and aiming a few rapid pecks with its beak, and then ignominiously took to flight, leaving a few feathers behind in its hurry. No sooner, however, had it quitted the field than about half a dozen other sparrows, who had been sitting on the chimney-pots in the neighbourhood watching the affray, dashed after it and chased it round and round the house, about half a dozen times, before they considered that it had had sufficient punishment. Such is an example of the annoyance my pigeons were sometimes subjected to by the sparrows. I may add that I have frequently observed sparrows and starlings fighting, and also on one occasion saw a sparrow chase a jackdaw which had evidently been attempting to take the sparrow's eggs or young ones. The records of a few other curious instances of birds fighting which I will briefly extract from my diary may perhaps be interesting. "1880 May. Saw a starling attack and drive away two jackdaws which had gone in quest of its eggs. 1880 June. Saw a cloud of redpolls chase a cuckoo. 1883 June. Witnessed a desperate fight between a flock of jackdaws and a heron, in mid air. 1885 June. Saw a skylark chase a cuckoo and drive it away. 1885 August. Saw a mistletoe thrush chase a sparrow-hawk and drive it away. 1886 July. Witnessed a great battle between a large flock of starlings and a flock of rooks, the former having invaded the feeding-grounds of the latter." W. HARCOURT BATH.

Ladywood, Birmingham, April 25.

THE ROYAL SOCIETY SELECTED CANDIDATES.

THE following is the list of the fifteen candidates selected by the Council of the Royal Society, at their meeting last Thursday, to be recommended for election into the Society. The ballot will take place on Thursday, June 9, at 4 p.m. We print with the name of each of the candidates the statement of his qualifications.

JOHN YOUNG BUCHANAN, M.A. (Glasgow),

F.R.S.E., F.C.S. Chemist and Physicist to the *Challenger* Expedition, 1872–76. Invented and improved apparatus and methods for collecting and analysing ocean water. Author of "Report of the Specific Gravity of Ocean Water" (Part 2, vol. i., of "The Voyage of H.M.S. *Challenger*"). Since the return of the *Challenger*, Mr. Buchanan has continued his investigations in the steam-yacht specially fitted up by him for the purpose. The following are the titles of some of the papers contributed by him to scientific Transactions and Journals: "Sur l'acide chloropropionique" (*Comp. Rend.*, lxv., p. 417); "On the Formation and Decomposition of some Chlorinated Acids" (Proc. Roy. Soc. Edin., vii., p. 419); "On the Absorption of Carbonic Acid by Saline Solutions" (Proc. Roy. Soc., xxii., pp. 192 and 483); "On the Specific Gravity of Ocean Water" (Proc. Roy. Soc. Edin , ix., 283); "On the Compressibility of Glass" (Trans. Roy. Soc. Edin., 1880); "On a Solar Calorimeter, and some Observations made with it in Upper Egypt" (Proc. Roy. Soc. Edin., xi., 827).

J. THEODORE CASH, M.D., C.M.,

Has devoted himself to physiological and pharmacological science, and has made discoveries in these as described in the following works, of which he is the author:—"On the Relationship between the Muscle and its Contraction" (*Journ. Anat. Phys.*, vol. xv.); "Ueber den Antheil des Magens und des Pancreas an der Verdauung des Fettes" (*Arch. für Physiol.*, 1880); "Description of a Double Cardiograph for the Frog's Heart" (*Journ. of Physiol.*, vol. iv.). With Dr. Lauder Brunton:—"Contributions to our Knowledge of the Connexion between Chemical Constitution, Physiological Action and Antagonism" (Phil. Trans., 1884); "Action of Alkaloids on Oxidation" (St. Barth. Hosp. Rept., vol. xviii.); "Influence of Heat and Cold on Muscles poisoned by Veratria" (*Journ. of Physiol.*, vol. iv.); "On the Valvular Action of the Larynx" (*Journ. Anat. Phys.*, vol. xvii.); "On the Effect of Electrical Stimulation of the Frog's Heart, and its Modification by Heat, Cold, and the Action of Drugs" (Proc. Roy. Soc., vol. xxxv.); "Ueber Vorbeugende Gegengifte" (*Centralb. für d. Med. Wiss.*, 1884); and several other papers. With Dr. Yeo:—"The Effects of certain Modifying Influences on the Latent Period of Muscle Contraction" (Proc. Roy. Soc., vol. xxxiii.); "The Variations of Latency in certain Skeletal Muscles" (Proc. Roy. Soc., vol. xxxv.); "On the Relationship between the Active Phases of Contraction and the Latent Period of Skeletal Muscle" (*Journ. of Physiol.*, vol. iv.).

SIR JAMES NICHOLAS DOUGLASS,

Civil and Mechanical Engineer. Engineer-in-Chief to the Hon. Corporation of Trinity House. Is a Member of the Smeatonian Society of Civil Engineers and a Member of the Council of the Inst. Civ. Eng. Member Inst. Mech. Eng. Has been attached to coast signalling since 1847, and the development of electricity for coast lighting since 1862. Has designed and erected several rock lighthouses on the coasts of this country and abroad; some of these works being of exceptional difficulty, for which he received on two occasions a testimonial from the Hon. Corporation of Trinity House. He designed and erected the new Eddystone Lighthouse. On the completion of this work he received the honour of knighthood. He has very materially improved the optical apparatus, lamps, lanterns, and fog-signal apparatus of lighthouses and light-vessels. Is the author of several papers. For one on "The Wolf Rock Lighthouse," and another on "The Electric Light applied to Lighthouse Illumination" (Proc. Inst. Civ. Eng., vols. xxx. and lvii.), he received the Telford and Watt Gold Medals of the Institution of Civil Engineers.

PROF. J. A. EWING, B.Sc. (Edin.),

Professor of Engineering, University College, Dundee. Author of papers contributed to the Royal Society treating of the Thermo-electric quality of metals; the Electric effect due to twisting Iron and Steel wire when magnetised; and various papers on the Magnetic Qualities of Iron and Steel, all of which have been published (see Proc. Roy. Soc., Nos. 205, 210, 214, 216, 220, and the present volume of the Transactions). Well known for his work in connexion with the observation and recording of Earthquake Phenomena, having contributed numerous papers on this subject to the Seismological Society of Japan; is also joint author with the late Prof. Fleeming Jenkin of several papers communicated to the Royal Society of Edinburgh, and published in the Transactions of that Society. Was for five years in Japan as Professor of Engineering, and has held his present Chair (Dundee) for two and a half years.

PROF. GEORGE FORBES, M.A.,

F.R.S. Edin., F.R.A.S. Member of the Astronomische Gesellschaft, of the Electro-technical Society of Vienna, and of the Society of Telegraph-Engineers. Associate of the Inst. Civil Engineers. Chevalier of the Legion of Honour. Formerly Professor of Natural Philosophy at Anderson's College, Glasgow. Consulting Engineer (Electrical). Author of the following amongst other papers:—"On the Meteoric Shower of November 14, 1866" (*Phil. Mag.* 1867); "On the Meteor-Shower of August 1867;" "On Astronomical Refraction;" "On certain Connexions between the Molecular Properties of Metals;" "On Irradiation;" "On Thermal Conductivity;" "On an Instrument for Indicating and Measuring the Fire-damp in Mines," &c. (Brit. Assoc. Rep., 1867, 1872, 1873, 1878, &c.); "Note on the Zodiacal Light;" "On the After-glow of Cooling Iron at a Dull Red Heat;" "On Diamagnetic Rotation;" "On Comets;" "On the Theory of the Telephone;" "On an Ultra-Neptunian Planet, &c." (Proc. Roy. Soc. Edin., vols. viii., ix., x.); "On the Velocity of White and Coloured Light" (in conjunction with the late Dr. James Young, F.R.S.—Phil. Trans., 1882). Also author or joint author of the following separate works, published by Macmillan:—I. "The Transit of Venus;" II. "Rendu's Theory of Glaciers."

WILLIAM RICHARD GOWERS, M.D. (Lond.),

F.R.C.P. Fellow of University College, London. Physician to University College Hospital, and to the National Hospital for the Paralysed and Epileptic. Distinguished as a Physiologist and Physician. Attached to science and anxious to promote its progress. Contributor of papers on:—"The Automatic Action of the Sphincter Ani" (Proc. Roy. Soc., 1877); "The Decupation of the Optic Nerves" (*Centralb. für d. Med. Wiss.*, 1878); "The Enumeration of Blood-Corpuscles" (*Practitioner*, 1878); "The Estimation of Hæmoglobin" (Trans. Clin. Soc., 1878); "The Nature of the So-called Tendon-reflex Phenomena" (Trans. Roy. Med. Chir. Soc., vol. lxii.); "The Mechanism of the Movements of the Eyelids" (*ibid.*); "A Reflex Mechanism in the Fixation of the Eyeballs" (*Brain*, vol. ii.); "The Relation of the Fifth Nerve to Taste" (*Journ. of Phys.*, 1883); "The Origin of the Sixth Nerve" (*Centralb. für d. Med. Wiss.*, 1878); "Unilateral Lesion of the Spinal Cord" (Trans. Clin. Soc., vol. xi.). Author of treatises:—"Manual and Atlas of Medical Ophthalmoscopy," second edition; "Epilepsy and other Chronic Convulsive Diseases;" "Diagnosis of Diseases of the Spinal Cord," second edition; "Diagnosis of Diseases of the Brain;" "Pseudo-hypertrophic Muscular Paralysis;" "Diseases of the Walls of the Heart;" "Leucocythæmia;" "Hodgkin's Disease;" Reynold's System of Medicine;" "Path. Anat. of Hydrophobia;" "Mode of Development of Spindle Cells," &c., &c.

ALEXANDER BLACKIE WILLIAM KENNEDY, M.I.C.E.

Civil Engineer. Professor of Engineering and Mechanical Technology, University College, London. Has rendered considerable services to Engineering Education by the establishment of an Engineering Laboratory at University College, and by his investigations there made into the strength of materials (Journ. Soc. Arts, 1875). The students are there taught systematic experimental work, and the plan first introduced by Prof. Kennedy has been generally followed. Tests were there made on strength and elasticity for the Indian Government, and accounts of other tests are given in the reports on riveted joints for Institution of Mechanical Engineers, and in a paper on mild steel written for Roy. Inst. Brit. Architects. He translated and edited "Theoretische Kinematik." He is the author of numerous papers connected with Engineering, as the "Critical Description of the Steam-Engines, &c.," in the Vienna Exhibition, 1873 *Engineering*, June, December, 1873); "Air-Engines" (*Engineering*, 1875); "Geometrical Solutions of some Statical Problems" (Proc. Lond. Math. Soc., vol. ix.). He has also designed the iron and concrete framework and roof of the new Alhambra Theatre.

GEORGE KING, M.B.,

F.L.S. Superintendent of the Royal Botanical Gardens, Calcutta, and of the Government Cinchona Plantations of Darjeeling. Formerly Superintendent of the Botanical Gardens of Saharunpur. Author of "Notes on the Lion of Aboo" (Proc. Asiat. Soc. Beng., 1868); "On the Birds of the Goona District" (Journ. Asiat. Soc. Beng., 1868); "Notes on the Vegetable Products and Farm Foods of Rajpootana and Marwan;" "Observations on the genus *Ficus*, and on the Fertilisation of *F. hispida*;" "A Monograph of Indian Fici" (in course of publication). Eminent as an Indian Botanist and Quinologist, and for the services he has rendered to Botanists and Naturalists in India.

SIR JOHN KIRK, G.C.M.G., M.D.,

F.L.S. H.M. Agent and Consul-General, Zanzibar. Chief Officer and Naturalist of Dr. Livingstone's Government Expedition to the Zambesi, Nyassa Country (1858–63), during which he made large collections, observations, and drawings of great scientific value. Author of numerous contributions to the Botany, Zoology, and Geography of Eastern Tropical Africa, published in the Journals of the Linnean and Zoological Societies, the *Ibis*, &c. During Sir John Kirk's residence, of nearly twenty years, in Zanzibar, he has rendered most important services to the various Expeditions despatched by English and Foreign Governments and by private bodies for the exploration of Central Africa, directing their routes, superintending their equipments, and encouraging them in the formation and transmission of Zoological, Botanical, and Ethnological Collections.

OLIVER JOSEPH LODGE, D.Sc. (Lond.),

Professor of Physics in University College, Liverpool. Distinguished for his acquaintance with the science of Physics. Author of numerous papers on Physics published in the *Philosophical Magazine*, Proceedings of the Physical Society of London, Reports of the British Association, and elsewhere, including (among many others) the following:—"On some Problems connected with the flow of Electricity in a Plane;" "On a Model illustrating mechanically the passage of Electricity through Metals, Electrolytes, and Dielectrics according to Maxwell's Theory;" "On a Mechanical Illustration of Thermo-electric Phenomena;" "On a Modification of Mance's Method of measuring Battery Resistance;" "On a Method of measuring absolutely the Thermal Conductivity of Crystals;" "An attempt at a Systematic Classification of some of the Forms of Energy;" "On Intermittent Currents and the Theory of the Induction Balance;" "On the Dimensions of a Magnetic Pole in the Electrostatic System of Units;" "On the Phenomena exhibited by Dusty Air in the neighbourhood of strongly Illuminated Bodies" (jointly with the late J. W. Clark); "On the seat of Electromotive Force in the Galvanic Circuit;" "On the Identity of Energy;" "On Electrolysis;" author of a book on "The Elements of Mechanics" (W. and R. Chambers).

PROF. JOHN MILNE,

F.G.S., Associate and Hon. Fellow of King's Coll. Lond. Royal Exhibitioner at Royal School of Mines, Lond. Professor of Mining and Geology in the Imperial College of Engineering, Department of Public Works, Japan. Studied in Freiberg; travelled in Iceland; engaged, in 1873–74, in mining in Newfoundland; accompanied Dr. Beke as geologist to North-West Arabia; travelled across Russia, Siberia, Mongolia, and China to Japan; visited the Kurile Islands, the Corean frontier, California, &c. Author of "Travelling Notes" (*Geol. Mag.*, 1877, pp. 237, 289, 389, 459, 511, 557; 1878, pp. 29, 62); "The Volcana of Oshima" (*op. cit.*, 1877, p. 193); "On the Form of Volcanoes" (*op. cit.*, 1878, p. 337, pl. IX.; and 1879, p. 506); "The Volcanoes of the Kurile Islands" (*op. cit.*, 1879, p. 337, pl. IX.); "On the Cooling of the Earth" (*op. cit.*, 1880, p. 99); "Physical Features and Mineralogy of Newfoundland" (Quart. Journ. Geol. Soc., 1874, vol. xxx., p. 722); "Geological Notes on the Sinaitic Peninsula and N.W. Arabia (*ibid.*, vol. xxxi., pp. 1–28); "Seismic Science in Japan" (Trans. Seismol. Soc., Yedo, vol. i., pp. 1–34); "The Earthquake of February 22, 1880" (*op. cit.*, vol. i., part ii., pp. 1–116); "The Earthquakes of Yedo Plain" (*ibid.*, vol. ii., pp. 1–38); "The Peruvian Earthquake of May 9, 1877" (*ibid.*, vol. ii., pp. 51–96); "Experiments in Seismology" (*ibid.*, vol. iii., pp. 12–64); "Notes on the Great Earthquakes of Japan" (*ibid.*, vol. iii., pp. 65–102); "The Earthquake of March 8, 1881" (*ibid.*, pp. 127–136); "Distribution of Seismic Activity in Japan" (vol. iv., pp. 1–30); "The Systematic Observation of Earthquakes" (*ibid.*, vol. iv., pp. 87–117; joint papers with Mr. T. Gray, B.Sc., F.R.S.E.); "On Seismic Experiments" (Phil. Trans., 1882, and Proc. Roy. Soc., 1881); "Earthquake Observations in Japan" (*Phil. Mag.*, November 1881); "Elasticity and Strength, Constants of Certain Rocks" (1882); "Reports on Investigation of the Earthquake Phenomena of Japan" (Brit. Assoc. Rep., 1881 and 1882). Intrusted with three grants from British Association for the investigation of earthquake phenomena. Author of numerous other papers on geology, mineralogy, mining, &c. Has specially devoted himself to the study of earth-movements.

REV. OCTAVIUS PICKARD-CAMBRIDGE, M.A.,

Rector of Bloxworth, Dorset. Distinguished for his acquaintance with Zoology, particularly Arachnology. Has published the following works:—"A History of British Spiders to 1881," entitled "Spiders of Dorset," with Preface and General Introduction in two vols., pp. 1-625, plates 1-6; numerous papers in the Proc. Zool. Soc. of London, especially "On the Spiders of Palestine and Egypt from 1869 to 1883;" article "Arachnida" in "Encyclop. Brit.," 1874; articles "Arachnida" in "Zoological Record," 1870-1883; numerous papers "On Arachnida of various Countries" in *Ann. Mag. Nat. Hist.*, 1860-83; articles "On British Spiders" in Trans. Linn. Soc., 1868-70; articles "On British and Exotic Spiders" in Proc. Linn. Soc., vols. x. and xi.

GEORGE JAMES SNELUS,

A.R.S.M., F.C.S., Memb. I.M.E. Metallurgist. Is distinguished as a chemist and metallurgical engineer. He was the first to make pure steel from phosphoric pig iron in a Bessemer converter lined with basic materials, a discovery of national importance, for which he was, in 1883, awarded the Bessemer Gold Medal of the Iron and Steel Institute. He has developed points of much scientific interest in connexion with the mode of existence of carbon and silicon in iron and steel, and has specially studied the liquidation of fluid bodies during the solidification of steel. He has also conducted important researches on the relation between the chemical composition and mechanical properties of steel used for rails. Is the author of the following papers :—"On the Condition of Carbon and Silicon in Iron and Steel"; "On the Composition of the Gases evolved from the Bessemer Converter"; "On the Scientific Features of the Danks' Puddling Furnace"; "On the Manufacture and Use of Spiegeleisen"; "On Fire-Clay and other Refractory Materials"; "On the Direct Process of Steel Making"; "On the Removal of Phosphorus and Sulphur in the Bessemer Process"; "On the Distribution of Elements in Steel Ingots"; "On the Chemical Composition and Testing of Steel Rails."

THOMAS LORD WALSINGHAM.

Trustee of the British Museum. A practical Entomologist and ardent student and collector of the Microlepidoptera, of which he has an extensive private collection. In 1872, Lord Walsingham made a special expedition to Northern California and Oregon, and besides forming a large series of the Microlepidoptera of that district, many of which were unknown, obtained a good collection of other Natural History specimens, which he presented to the Cambridge Museum.—[ADDENDUM.—Author of "Catalogue of North American Tortricidæ in the British Museum," 4to., being Part 4 of "Illustrations of Typical Specimens of Lepidoptera Heterocera," 1879, and published by the Trustees. "On some Probable Causes of a Tendency to Melanic Variation in Lepidoptera of High Latitudes" (Presidential Address, Trans. Yorksh. Nat. Union, 1885); and various papers in the Trans. Ent. Soc. and Proc. Zool. Soc., 1880–84.]

WILLIAM WHITAKER, B.A. (Lond.),

F.G.S. Assoc. Inst. C.E. District Surveyor on the Geological Survey of England and Wales. Contributor to, or author of, ten of the Memoirs of the Geological Survey, among these being—"The Geology of the London Basin;" "The Geology of the N.W. part of Essex, and the Geology of the country round Ipswich;" of Papers in the Quarterly Journal of the Geological Society on the "Western end of the London Basin;" "The Lower Tertiaries of Kent;" "On some Borings in Kent, and other subjects;" and of many other papers on geology, more especially of the Cretaceous and Tertiary Beds, and on the subject of water-supply. Has also drawn up many lists valuable to the student of geological literature, and was for several years Editor of the *Geological Record*. Awarded the Murchison Medal of the Geological Society, 1886.

THE PARIS ASTRONOMICAL CONGRESS.

WE have now received a considerable instalment of the *procès-verbaux* of the sittings of the Conference, and although those of the final meeting are not yet to hand, we think it important to give, in continuation of our article in a recent number, an account of the work done, so far as the information has reached us, the Conference having sat every day, except Sunday, from the 16th to the 25th.

The meetings, which took place in the large hall of the Paris Observatory, were attended by the following astronomers and physicists, the names being given alphabetically :—Auwers, Berlin; Baillaud, Toulouse; Bakhuyzen, Leyden; Bertrand, Paris; Beuf, La Plata; Bouquet de la Grye, Paris; Brunner, Paris; Christie, Greenwich; Cloué, Paris; Common, Ealing; Cornu, Paris; Cruls, Brazil; Donner, Helsingfors; Dunér, Lund; Eder, Vienna; Elkin, America; Faye, Paris; Fizeau, Paris; Folie, Brussels; Gautier, Geneva; Gill, Cape of Good Hope; Gyldén, Stockholm; Hasselberg, Pulkova; Henry (Brothers), Paris; Janssen, Meudon; Kapteyn, Gröningen; Knobel, London; Krueger, Kiel; Laussedat, Paris; Liard, Paris; Lœwy, Paris; Lohse, Potsdam; Mouchez, Paris; Oom, Lisbon; Oudemans, Utrecht; Pechüle, Copenhagen; Perrier, Paris; Perry, Stonyhurst; Peters, Clinton; Pujazon, Cadiz; Rayet, Bordeaux; Roberts, Liverpool; Russel, Sydney; Schönfeld, Bonn; Steinheil, Munich; Struve, Pulkova; Tacchini, Rome; Tennant, Ealing; Thiele, Copenhagen; Tisserand, Paris; Trépied, Algiers; Vogel, Potsdam; Weiss, Vienna; Winterhalter, Washington; Wolf, Paris. With a few exceptions we have in this list all the men engaged in astronomical photography.

In our former article we gave an account of the first general meeting, held on April 16. The second took place on the 19th. The names of those present were as follow :—

President, M. Struve; Vice-President, Mr. Christie; Messrs. Auwers, Baillaud, Bakhuyzen, Beuf, Bigourdan, Bouquet de la Grye, Common, Cornu, Cruls, Donner, Dunér, Eder, Elkin, Fizeau, Gautier, Gill, Gyldén, Hasselberg, Paul Henry, Prosper Henry, Janssen, Kapteyn, Knobel, Krueger, Lœwy, Lohse, Mouchez, Oom, Oudemans, Pechüle, Perry, Peters, Pujazon, Rayet, Roberts, Russell, Schönfeld, Steinheil, Tacchini, Thiele, Tisserand, Trépied, Vogel, Weiss, Winterhalter, and Wolf.

M. Struve commenced the proceedings by giving an account of the resolutions adopted by a small technical Committee, which resolutions had been prepared by M. Lœwy. They had been suggested by the desire that a great number of Observatories should participate in the work; that the price of the instruments should be moderate; and that the work should be completed in the smallest time possible compatible with thoroughness.

The following conclusions of the Committee were adopted without discussion, and agreed to unanimously :—

(1) The instruments employed shall be exclusively refractors, and may be made locally provided the conditions laid down by the Conference are fulfilled.

(2) The stars shall be photographed as far as the fourteenth magnitude inclusively; this magnitude being indicated provisionally by the scale actually in use in France, and with the reservation that the photographic value shall be definitely fixed afterwards.

The third conclusion gave rise to a considerable amount of discussion, and was finally approved as follows :—

(3) The aperture of the object-glasses shall be 0·33 metre, and the focal length about 3·43 metres, so that a minute of arc shall be represented approximately by 0·001 metre.

The division of the Congress into sections for the study of special questions was next considered, and it was determined that there should be two sections, one to deal with purely astronomical questions, and the other with those involving photography.

It was arranged that these sections should not meet at the same time, and that each section should appoint its officers at the first meeting.

We next come to the work of the Photographic Section, which held two meetings on April 20 and 21.

M. Auwers, the Vice-President of the Conference, took the chair, and proposed that M. Janssen should be appointed President. This proposition was adopted with acclamation. The bureau of this section was composed as follows :—

President, M. Janssen; Secretaries, MM. Dunér and Trépied; and MM. Auwers, Bakhuyzen, Christie, Cloué, Common, Cornu, Cruls, Eder, Fizeau, P. Gautier, Gill, Hasselberg, Paul Henry, Prosper Henry, Kapteyn, Knobel, Krueger, Laussedat, Lœwy, Mouchez, Oudemans, Pechüle,

Peters, Pujason, Roberts, Steinheil, Tacchini, Thiele, Vogel, Weiss, Winterhalter, and Wolf.

The proceedings of the section were opened by M. Cornu in a long speech which gave rise to a very lengthened discussion.

The three following resolutions were finally arrived at:—

(1) All the plates to be used should be prepared according to an identical formula to be subsequently determined.

(2) A permanent control of these plates from a point of view of their relative sensibility to the different radiations shall be instituted.

(3) The aplanatism and achromatism of the object-glasses employed shall be calculated for the wave-lengths near Fraunhofer's G.

At the second meeting the last resolution was re-discussed, and another one was passed modifying it as follows:—

"The resolution adopted at the last meeting relating to the aplanatism and achromatism of the object-glasses shall be understood in the sense that the minimum focal distance shall be that of a ray near G with a view to obtain the maximum sensibility of the photographic plates."

An important letter was read from Mr. Vogel, the Director of the Potsdam Observatory, relating to the preparation of the plates and suggesting the construction of a sensitometer.

The Committee then passed on to consider the extent of the photographic field.

With regard to the question of the distortion of images of stars away from the centre of the field, the Astronomer-Royal gave the results of calculations which he had made to determine the dimensions of the elliptic images of stars at different distances from the centre of the field, supposing that at the centre the image is reduced to a point.

Calling the axes of the ellipses a and b, the Astronomer-Royal's results are as follows:—

Angular distance from the centre of the field.		a.		b.
°		″		″
0·0	...	0·0	...	0·0
0·5	...	3·0	...	1·3
1·0	...	11·0	...	5·0
1·5	...	24·0	...	11·0
2·0	...	44·0	...	20·0

The results of these calculations agree very satisfactorily with measurements actually made on some of the Brothers Henry's star photographs.

It was suggested that, by placing the centre of the plate slightly inside the focus, one might be able by a sort of compensation to diminish the distortions of the more distant parts of the field, and thus to augment the usable extent of field.

Finally, the following resolution was passed:—

"The object-glasses shall be constructed in such a manner that the field to be measured shall extend at least 1° from the centre."

The decision was almost unanimous, three only voting against it.

Dunér then raised the question of duplicating the observations on the same or different plates.

There was a unanimous feeling that, although more than 10,000 plates would be required if four square degrees of surface were agreed upon for the field, two series of negatives must be obtained for the whole heavens; the plates being so arranged that the star at the corner of one plate shall be at the centre of another.

The work of the meeting was terminated by suggesting the appointment of two special Commissions to consider questions relating to the safe keeping and reproduction of the negatives, and also to the determination of photographic magnitudes.

We next come to the meetings of the Astronomical Section, which met on April 20, 21, and 22.

The first part of the programme of this section was the examination of the methods and instrumental details which will enable the orientation of the plates and the value of the scale to be precisely determined. The question discussed was whether the actual plates recording the stars down to the fourteenth magnitude could be used for the determination of fundamental positions. It was ultimately determined to have two series of photographs, but no resolution was arrived at at the first meeting.

At the second meeting this matter was settled by the following resolution, which was carried unanimously, with one exception:—

"Besides the negatives giving the stars down to the fourteenth magnitude, another series should be made with shorter exposures, to assure a greater precision in the micrometrical measurement of the fundamental stars, and render possible the construction of a catalogue."

At the third meeting the President remarked that, as the section had finished its deliberations, it was desirable to arrive at final resolutions on the questions referred to it.

M. Auwers proposed the following resolution:—

"The supplementary negatives destined for the construction of the catalogue shall contain all the stars down to the eleventh magnitude inclusive. The Executive Committee shall determine the steps to be taken to insure that this condition is fulfilled."

This was carried by 25 votes to 6; some members being in favour of tenth magitude only.

The second resolution, which was unanimously agreed to, ran as follows:—

"The photographic plates to be used in formation of the catalogue shall be accompanied by all the data necessary to obtain the orientation and the value of its scale; and as far as possible these data shall be written on the plate itself.

"Each plate of this kind shall show a well centred copy of a system of cross-wires to insure the determination of errors of the field, and to eliminate those which may be produced by a subsequent deformation of the photographic film.

"Further details of this nature shall be determined by the Executive Committee."

The following resolutions were next carried:—

"In the negatives destined for the map the number of cross-wires to be used in their control and reduction shall be reduced to a minimum."

"The tubes of the photographic instruments shall be constructed of the metal most likely to give an invariable focal plane, and shall carry a graduation for the determination and regulation of the position of the plate."

"The Executive Committee shall choose the reference stars to be used."

"The question of the methods of measurement and the conversion of the numbers obtained in right ascension and declination for the equinox of 1900 is left to the Executive Committee."

"That Committee shall first occupy itself with the study, and methods of use, of measuring-instruments giving either rectangular or Polar co-ordinates, and based upon the simultaneous use of scales for the larger distances and micrometer eye-pieces for scale subdivisions."

Although we are unable to give, this week, a complete account of the final doings of the Conference, what was done at the last meeting is partly known, and it is clear that the Conference has been a great success, and that much solid work has been accomplished by the forty or fifty astronomers who attended one meeting or the other.

At the final general meeting Admiral Mouchez announced that all necessary arrangements had been made with the French Government to enable the Observatories of Paris, Algiers, Bordeaux, and Toulouse, to accept at once the conditions proposed by the Conference. M. Cruls, Director of the Rio Observatory, and M. Beuf, Director of the La Plata Observatory, also accepted at once the same conditions; their instruments being already ordered, and all expenses provided for. Most of the official astronomers had not as yet obtained the necessary grants of money from their respective Governments; but among those who expressed their readiness to take a share in the work, if funds can be provided, were Struve, of Pulkova; Weiss, of Vienna; Auwers, of Berlin; Christie, of Greenwich; Pujazon, of San Fernando; Oom, of Lisbon; Gill, of the Cape; and Russell, of Sydney, who answered also for Ellery, of Melbourne. Prof. Peters, speaking for the United States, said that ten of their Observatories were anxious to join in this undertaking, but he did not know whether they would accept the conditions proposed by the Conference. Omitting, therefore, these ten doubtful Observatories, we see that already four Observatories in the North and two in the South have given in their adhesion, and these will probably soon be joined by six other leading Observatories in the northern hemisphere and by three in the southern. Henceforward we need have no time or money spent on stellar photographs which will not find their place in a well-thought-out and general scheme.

The estimated cost for each Observatory, including instruments, extra assistant, plates, measurements, &c., is about £4000.

We believe that among the resolutions arrived at at the last meeting was one recommending the erection by France of an Observatory at Réunion, and by England of one in New Zealand.

The Permanent Committee appointed consists of all the Directors of the Observatories taking part in the work, with a certain number of members not necessarily actually engaged in this work. The names of the Committee are Christie, Dunér, Gill, Prosper Henry, Janssen, Lœwy, Pickering, Struve, Tacchini, Vogel, Weiss; and, as Directors of Observatories who have decided already to join, Cruls, Beuf, Mouchez, Trépied, Baillaud, and Rayet.

The Conference nominated Janssen and Common as a Committee to consider the application of photography to other celestial bodies not included in the scheme of a photographic chart.

The hospitality of the French Government and men of science to the members of the Conference can be judged from the following list of festivities provided in their honour. In addition to the welcome of the Conference by the Minister of Foreign Affairs already mentioned, Admiral Mouchez gave a *soirée* at the Observatory on Tuesday evening, April 19. The Bureau of the Conference were presented to the President of the Republic on Wednesday, the 20th. A banquet was given by the Minister of Foreign Affairs at his official residence, on Thursday, the 21st. M. Janssen invited the Conference to his Observatory at Meudon on Friday afternoon, the 22nd. On Saturday there was a ball at the Hôtel Continental and a special performance of "Hamlet" at the Comédie Française on Sunday. A banquet was given by Admiral Mouchez at the Observatory, on Sunday, to all the members of the Conference and many of the leading French *savants*, including MM. de Lesseps, Frémy, Bęcquerel, Hébert, and others. On Saturday, the 23rd, the English astronomers gave a dinner to their French *confrères*; the Astronomer-Royal presided, Mrs. Christie was also present.

ON ICE AND BRINES.[1]

II.

THE second part of the paper is occupied by the study of the melting of pure ice in sea-water and other saline solutions. A large number of experiments were made with solutions of concentration comparable with that of sea-water, and in one or two cases the experiments were extended to low temperatures and strong solutions. As a rule, from 50 to 100 grammes of solution, cooled to 0° C., were mixed with an equal weight of pounded ice, also at 0° C. The thermometer used for all these determinations was one of Geissler's normal ones, divided into tenths of a degree Centigrade; and its zero-point was verified almost daily. Along with the thermometer, a pipette of suitable capacity was immersed in the beaker, and used with the thermometer for keeping the mass well mixed. Its upper aperture was closed with a small cork, which was removed from time to time to permit of some of the brine being sucked up and allowed to run back again. The inside of the pipette was thus kept constantly moistened with the slowly altering solution in the beaker. The temperature was read after very thorough mixing and the sample thereupon immediately removed and preserved for analysis.

As a rule samples were taken for analysis at intervals of 0°·4 C. The results for three classes of salt in dilute solutions are arranged in Tables IV., V., and VI.

TABLE IV.—*Giving the percentage of chlorine in solutions of various chlorides in which ice melts at given temperatures.*

Temperature of melting ice.	Chloride in solution.						
	HCl.	NaCl.	KCl.	(Sea-Water.)	$MgCl_2$.	$CaCl_2$.	$BaCl_2$.
	Per cent. chlorine in solution.						
°C.							
−3·5	3·06	3·30	—	—	4·12	—	—
−3·0	2·68	3·02	3·00	—	3·62	3·70	—
−2·5	2·28	2·53	2·50	—	3·12	3·20	—
−2·0	1·85	2·02	2·00	—	2·62	2·70	2·72
−1·5	—	1·50	1·50	1·500	1·19	2·15	2·10
−1·0	—	1·02	1·02	1·034	1·51	1·50	1·47
−0·5	—	0·50	0·52	0·588	0·87	—	—

TABLE V.—*Giving percentage of K in solutions of various potassium salts in which ice melts at given temperatures.*

Temperature of melting ice.	Salt in Solution.			
	KCl.	KI.	$K\frac{Cl+I}{2}$	KOH.
	Per cent. K in Solution.			
°C.				
−3·0	3·29	3·02	3·15	—
−2·5	2·79	2·59	2·68	2·60
−2·0	2·28	2·13	2·17	2·08
−1·5	1·74	1·63	1·66	1·57
−1·0	1·18	1·13	1·12	—
−0·5	0·59	0·60	0·57	—

[1] Paper read before the Royal Society of Edinburgh, by J. Y. Buchanan, on March 27 last. Continued from vol. xxxv. p. 611.

TABLE VI.—*Giving percentage of hydrogen in solutions of various hydrogen salts in which ice melts at given temperatures.*

Temperature of melting ice.	Salt in solution.			
	H_2SO_4.	HCl.	HNO_3.	HKO.
	Per cent. H in solution.			
° C.				
−3·0	0·144	0·076	0·077	—
−2·5	0·119	0·065	0·065	0·066
−2·0	0·097	0·052	0·052	0·053
−1·5	0·073	—	0·042	0·041
−1·0	0·048	—	0·032	—

On considering them, it was at once evident that the lowering of the melting-point of ice followed the concentration of the solution, but the law deviated in all cases from that of strict proportionality to the amount of salt dissolved, in some cases to a greater extent than in others. In comparing the effects of different salts in solution on the melting-points of ice, no simple connexion could be traced between their absolute weights and the effects produced; but on comparing chemically equivalent weights, a very close connexion was discovered. This will be evident from the inspection of the tables. In each the first column contains the temperatures at which pure ice melts; and in the parallel columns, the percentages of chlorine, potassium, or hydrogen in the solutions of the salts indicated at the head of each column, when ice melts in them at the temperature indicated. The figures thus give numbers proportional in each table to the chemically equivalent weights of the different salts. They show at first that, whereas the presence of equal absolute weights in solution produces very different effects, the presence of chemically equivalent weights produces very similar effects. On closer inspection, it is seen that the effects are almost identical where the elements to which the common constituent is united belongs to the same group of the periodic series, and differ sharply where these elements belong to different groups. In the case of the chlorides of sodium and potassium the number expressing the percentage[1] of chlorine in the solution expresses equally the depression of the melting-point of ice in terms of the Centigrade scale. The same depression of melting temperature is produced by 10 per cent. less of chlorine united to hydrogen, and by 30 to 35 per cent. more of chlorine when united to magnesium, calcium, or barium.

The results obtained with sea-water are also given, for comparison. It will be seen that it behaves very approximately as a solution of chloride of sodium containing the same amount of chlorine.

It is perhaps not very astonishing that unit weight of potassium in saline solution should produce the same effect in lowering the melting-point of ice, whether it is united to Cl, to I, or to OH; but it shows clearly how independent this action is of the character of the body in solution when we find the effect produced by unit weight of hydrogen identical whether it is united to such opposite radicles as Cl or OK. Table VI. shows further the effect of valence. While a given weight of hydrogen produces the same effect in solution whether it be united to the very different but both univalent radicles Cl and OK, its effect is reduced by one-half when united to the bivalent SO_4. That valence is not the only factor is shown by comparing the effects of hydrogen and potassium when united to the common element, chlorine. Hydrochloric acid in solution produces a markedly more powerful lowering effect on the melting-point of ice than the equivalent amount of chloride of potassium. Of all the substances that I have experimented on, hydrochloric acid is the most energetic in reducing the melting-point of ice, and with ordinary strong acid and pounded ice there is no difficulty in producing temperatures as low as the freezing-point of mercury. In the case of hydrochloric acid, sulphuric acid, chloride of sodium, and chloride of calcium, I have carried my experiments to low temperatures and great concentration. But before passing to them it is well to consider the more dilute solutions with regard to their density.

That the mere density of the solution in which the ice is melting has no direct connexion with the lowering of its melting-point is shown by the following table, in which the specific gravities (at 15° C.) are given of the solutions of different salts which give the same depression of melting-point.

Temperature of melting.	Specific gravity of solutions of				
	NaCl.	KCl.	$MgCl_2$.	$CaCl_2$.	$BaCl_2$.
° C.					
−2·86	1·03370	1·03850	1·03893	1·04756	—
−1·8	1·02174	1·02535	1·02715	1·03262	1·06633

There are many similarities in the effects produced by greatly increasing the pressure upon pure water and by dissolving salts in it. First, there is an absolute diminution in the volume of the solution as compared with the sum of the volumes of its components; second, in virtue of this compression by molecular forces it has become less compressible by mechanical means; third, the temperature of maximum density and the freezing temperature are lowered; and fourth, the former of these two temperatures is lowered more rapidly than the latter. All these effects are produced *in kind* by increasing the pressure on pure water. Whether, or in how far, they agree in degree must be decided by future experiments.

Experiments with Concentrated Solutions.—Several series of experiments have been made with hydrochloric acid, chloride of sodium, and chloride of calcium, and also with sulphuric acid. Table VII. gives the results, in the same form as preceding tables, for the chlorides:—

TABLE VII.

Temperature of melting ice.	Salt dissolved.		
	HCl.	NaCl.	$CaCl_2$.
	Per cent. Cl in solution.		
° C.			
−35	15·26		
−30	13·98		15·97
−25	12·60		14·47
−20	11·00		12·65
−15	9·17	11·10	11·29
−10	7·02	8·40	8·93
− 5	4·15	4·72	5·65

It will be seen that, in proportion as the solution becomes more concentrated, further additions of salt produce a greater effect in lowering the melting-point of ice, and at a temperature of −15° C. equivalent weights of NaCl + $CaCl_2$ produce identical results. In Table VIII. the results for hydrochloric acid and sulphuric acid are given in terms of the percentage of hydrogen in the solution.

[1] All percentages are *by weight*.

TABLE VIII.

Temperature of melting ice.	Acid dissolved.	
	HCl.	H_2SO_4.
	Per cent. H in solution.	
°C.		
−25	0·355	0·538
−20	0·310	0·487
−15	0·258	0·418
−10	0·198	0·332
− 5	0·117	0·205

The temperatures given in these tables are all in terms of the same thermometer, which has not been verified for this part of its scale by comparison with a standard or with the air thermometer.

It is exceedingly difficult, as a rule, to ascertain the trustworthiness of a thermometer at low temperatures. This difficulty would be removed if the temperature at which ice melts in solutions of some very soluble salts of different concentrations were carefully and accurately determined with a good air thermometer. If, for instance, this were done for chloride of calcium solution, which in many ways would be a particularly convenient one, there would be no difficulty in verifying a thermometer at any moment at temperatures as low as −30° C. by mixing pounded ice with the strong solution, immersing the thermometer in it, taking a series of readings of the instrument, while a series of samples of the liquid is taken and in them the chlorine determined. There are considerable advantages in this method of verification of thermometers by chemical means, especially as it obviates the use of the air thermometer, which is always inconvenient. The experiments of Pfaundler and Schnegg on the freezing of aqueous solutions of sulphuric acid can be used for this purpose. But it would be better to have a series of observations made for the purpose with the more convenient chloride of calcium solution.

Freezing Mixtures.—The results obtained in examining the melting-point of ice in saline solutions affords data for mixing freezing baths of any degree of cooling power. With chloride of sodium, for instance, a rough rule is to have such an amount of salt dissolved in the brine that the percentage of chlorine shall give the desired temperature in Centigrade degrees below the freezing-point. In my experiments in freezing sea-water in quantities of 300 grammes, I usually made up the bath of 500 grammes pounded ice, 400 grammes water, and 45 grammes common salt. When mixed, the liquid contained about 4 per cent. Cl, and gave a temperature a little below −4° C. In the course of an hour the liquid would contain 3 per cent. to 3·25 per cent. Cl, and the temperature have risen to −3° C. By using such baths freezing operations can always be kept completely in hand.

Summary.—Owing to its peculiar physical properties it is impossible to prepare the crystalline solid which separates from sea-water and analogous saline solutions in a condition to enable the question, whether the salt does or does not form part of the solid matter of the crystals, to be solved directly by chemical analysis.

So far as chemical analysis is applicable, it is in favour of the salt belonging exclusively to the adhering brine. When sea-water is carefully frozen artificially, the ratio between the chlorine and the sulphuric acid is the same for the solid contents of the original water, the crystals, and the mother-liquor. It is exceedingly unlikely if part of the salt went into the crystals, leaving the remainder in the brine, that there would be no selective separation of its constituents.

It has been shown (and the whole of the second part of the paper is taken up with this subject) that snow or pure lake ice, which, when melting by itself or immersed in pure water at atmospheric pressure, melts at the constant temperature called 0° C. or 32° Fahr., changes its melting temperature when immersed in a saline solution. The altered melting temperature, however, is the same for solutions of the same composition (no doubt with some allowance for pressure) and different for solutions of different composition.

The temperature at which pure ice melts in a solution is identical with that at which ice separates from the same solution on being sufficiently cooled.

When sea-water is frozen to the extent of 15 per cent. of its mass, and the crystals so formed are allowed to melt in the liquid in which they have been produced, they melt exactly as they have been formed. If snow or pure ice be immersed in the brine formed by partially freezing sea-water, it melts at the same temperature as the ice which had been formed by freezing the sea-water, so long as the chemical composition is the same in each case.

When saline solutions are cooled for a sufficient length of time at a sufficiently low temperature, there arrives a certain concentration at a certain temperature, when further removal of heat causes solidification of the brine as a whole (cryohydrate).

The concentration necessary for the solidification of even the cryohydrate of highest melting temperature is such that in the *primary* freezing of sea-water in nature no such body can be formed. It would follow from this consideration alone that the first ice formed on the sea in Arctic regions consists of pure ice, and it is also certain that it would retain a large quantity of the residual sea-water in its interstices. During the winter this inclosed liquor would solidify in the interstices of the crystals to ice and cryohydrates, in so far as the temperature and the nature of the salts in solution would permit. From my experiments with chloride of calcium, and the existance of brines observed to remain liquid at −30° C. at the winter-quarters of the *Vega*, it is unlikely that sea-water, as a whole, can ever be completely solidified in nature. The presence of unfreezable or difficultly freezable brine in freshly-formed sea-water ice explains its eminently plastic character even at very low temperatures. The presence of similar unfrozen brine in natural land ice at temperatures neighbouring to 0° C. explains its slightly plastic character, which is sufficient to account for the slow fluid motion of glaciers under the long-continued pressure of their own weight.

The fact that cryohydrates of different salts solidify and melt at different temperatures, sufficiently explains the various composition of different specimens of *old* sea ice.

The physical phenomena observed in freezing sea-water and saline solutions of moderate concentration, are all easily and simply explained on the hypothesis that the crystalline body formed is pure ice. Thus, the heat removed in freezing sea-water to the extent of 15 per cent. of its mass accounted for the production of the same amount of ice as was given by calculation on the basis of the chlorine found in the mother-liquor.

The apparent expansion, near the melting-point, of ice formed by the freezing water which contains any salt at all is perfectly explained on the hypothesis that in the act of freezing the water rigidly excludes all saline matter from participation in its solidification.

The same applies to the latent heat of water containing salt in matter. Pettersson made two determinations of the latent heat of sea-water containing 1·927 per cent. Cl and 3·53 per cent. salt. The freezing took place in the one case between the temperatures −9°·0 and −7°·47 C., and in the other between −8°·35 and −6°·94 C., and the

results he found were 52·7 and 51·5. The mean initial temperature in these two experiments is −8°·7 C., and the mean final temperature −7°·2 C. At −7°·2 C., ice would form on cooling, and would melt on warming a solution of chloride of sodium containing 6·48 per cent. Cl, which represents 11·87 per cent. of the sea salt. In order to concentrate a brine containg 3·53 per cent. salt to one containing 11·87 per cent., 70 per cent. of the water in it must be removed. Hence in sea-water freezing at a final temperature of −7°·2 C., there is formed 70 per cent. of ice, and there remains liquid 30 per cent. of brine. Freezing began at the mean temperature −8°·7 C., and the latent heat of pure ice at this temperature is 75. Calculating the latent heat of this mixture from the heat liberated in the calorimeter during freezing, and assuming that the whole mass had solidified, Pettersson's results give the mean latent heat of this sea-water as 52·1. Calculating the apparent latent heat on the assumption that 70 per cent. of the mass solidifies into pure ice and that 30 per cent. remains liquid, we get the number 51·5. On all grounds therefore we must conclude that pure ice is the primary product in freezing sea-water and saline solutions of moderate concentration.

The fact that ice melts in sea-water at a temperature of −1°·6 C. to −1°·8 C., according to its saltness, explains the anomalous distribution of temperature in Antarctic waters, and furnishes an account of the motive power which draws the surface water of cold temperate regions into the deeper layers, and after dilution with the melted matter of the icebergs, to the surface layers of Antarctic latitudes. Forming as it does an important factor of oceanic circulation, this part of the subject was treated in a separate paper, of which an account has already been given in NATURE (vol. xxxv. p. 516).

THE CLASSIFICATION OF SPIDERS.[1]

ALTHOUGH Dr. Thorell's paper is nominally only a criticism of Dr. Bertkau's views, it is really a masterly sketch of the literature on the subject of the classification of spiders, and a review of the methods of various authors from Lister downwards. The two leading views at present held on this subject appear to be represented by the author (Dr. Thorell) and Dr. Bertkau. These two views may be stated generally as *anatomical* v. *biological*, the former being the basis of Dr. Bertkau's classification, the latter (combined with considerations of external structure) that of Dr. Thorell. Dr. Thorell successfully, as it appears to us, defends the classification provisionally adopted in 1869, in his work "On European Spiders," from the sweeping charge that it is neither natural nor equal, nor based on characters of sufficient importance and distinctly expressed, though at the same time he freely admits its inevitable imperfection. He shows that in no branch of Nature are the subordinate groups of exactly equal value, nor should it be expected that the same equal systematic value would be found in the subordinate groups of the class Arachnida. It is well to remember that zoologists have to form their groups out of such materials as have come to their hands ready provided for them by Nature. They cannot expect to advance natural science by constructing out of limited materials a perfectly symmetrical system, and then insisting that all the diverse forms of Nature shall, *nolens volens*, be stuffed somewhere or other into it. Equality, therefore, of systematic value in the various groups into which spiders (Araneidea) may be divided can at best be only approximate; and it seems evident that as our knowledge of structure, whether external or internal, or of habits as dependent on and arising out of structure, becomes more extensive and exact, so some further modifications may become necessary in the primary divisions of spiders. After subjecting Dr. Bertkau's classification (which is based principally on the breathing-organs) to a minute and destructive criticism, Dr. Thorell modifies his former views by reverting, in some measure, to the Latreillian division of spiders into (1) those possessing four air-sacs, *Tetrapneumones;* (2) those with two, *Dipneumones;* still, however, retaining the old Latreillian biological divisions, *Territelariæ*, *Tubitelariæ*, *Orbitelariæ*, &c., based on habits, because the groups so divided may yet be thoroughly and scientifically differentiated by important and trustworthy structural characters. These divisions (now called by Dr. Thorell "tribus") are, as is well known, seven in number, and each is subdivided into families, which, with few exceptions, include only European species, Dr. Thorell's opportunities for the study of exotic groups not enabling him to construct a more complete subdivision of all known spiders. Dr. Bertkau's primary division of the Araneidea is into two groups, called suborders—*Tetrasticta*, with four breathing-apertures, and *Tristicta*, with three. Dr. Thorell shows conclusively that in the present state of our knowledge of the respiratory system of spiders (though this is far advanced beyond what it was in Latreille's days, and in a great degree the advancement is admitted to be due to Dr. Bertkau's labours) these two suborders are artificial rather than natural; as are also his subdivisions of the *Tristicta*, which are based on the undoubtedly remarkable characters to which such great prominence was given by the late Mr. Blackwall, that is, the possession or absence of a *cribellum* and *calamistrum*, the use of these in primary subdivision bringing together spiders not closely allied by any other natural characters. Dr. Thorell attributes a certain amount of classificatory importance to these organs by his intercalation of the families of his largest "tribus" possessing them, in a kind of osculant or collateral way, and of the other "tribus" in which they are found, in a linear arrangement, guided, however, in both cases by their possessing such other characters as, in all instances, fully warrant the position assigned to them. The anatomical study of the *tracheæ* (properly so called) of spiders seems to be yet in its infancy. Certainly at present these organs of respiration do not appear to warrant the importance attributed to them by Dr. Bertkau; and although Dr. Thorell's primary subdivisions are, in their *names*, strictly speaking, based on only biological characters, yet in reality they severally enshroud the most important structural ones, and hold all known spiders in a fairly natural system. They are, moreover, well known, and appear likely to be adopted for some time yet to come, with more or less modification, by the majority of araneologists.

O. P. CAMBRIDGE.

[1] "On Dr. Bertkau's Classification of the Order Araneæ, or Spiders," by Dr. T. Thorell (*Ann. and Mag. N.H.*, April 1886, pp. 301–26). (See especially the following works by Dr. Bertkau:—"Versuch einer natürlichen Anordnung der Spinnen," *Archiv. für Naturgeschichte*, xliv. 1, pp. 351 *et seq.*, 1878; and "Ueber das Cribellum und Calamistrum; ein Beitrag zur Histologie, Biologie, und Systematik der Spinnen," *ibid.*, xlviii. 1, pp. 316 *et seq.*, 1882.)

CHRISTMAS ISLAND.

THE following account of the little-known Christmas Island, situated in the Indian Ocean, south of Java, may be of interest. Capt. Maclear and his officers collected a variety of specimens, which have been forwarded to the Museum of Natural History and to the Royal Gardens, Kew, but they do not seem to have succeeded in making their way through the dense jungle to the upper part of the island, to ascertain the geological character of the mountain originally protruded from the depths. It is a little remarkable that, in a sea so calculated to encourage coral growth, no new reefs should have formed round the island since the ancient ones were elevated above the surface The Cocos or Keeling

Islands, 500 miles to the westward, are a well-known example of thriving coral life.

W. J. L. WHARTON.

H.M. Surveying-Vessel "Flying-Fish," January 31, 1887.

Christmas Island is 190 miles from the nearest point of Java, from which it is separated by a depth of 2450 fathoms. It is formed of coral limestone, has no fringing reef, but rises abruptly from the sea in cliffs about 30 feet high, very much underworn, and in many places hollowed out in caverns; the shore is steep-to: generally a depth of 100 fathoms is found at one to two cables from the cliffs.

In appearance it is somewhat saddle-shaped, rising from a long back in the middle, 700 to 800 feet high, to hills at the north-eastern and at the western sides; the western summit is double, and is the best-defined mark: its height is 1580 feet. The shape is irregular quadrilateral; it extends through 12′ of latitude, and about the same in longitude.

The island is densely wooded all over, except where the cliffs are too steep to allow anything to grow. From the northern side the ascent is gradual to the highest parts; but on the southern side, after rising gradually for half a mile from the sea cliffs, a second wall of limestone cliffs is met, estimated at 200 to 300 feet high, and thence slopes gently again to the top.

The shore cliffs are almost continuous, making the island inaccessible except at a few places. These cliffs are split by deep fissures extending several feet below water; where these have become enlarged, and the adjacent cliffs have fallen in, a small white beach of fragmentary rock is thrown up, and at such places on the lee-side landing can be effected.

From the blown direction of the trees on the south side, and from the weather-worn aspect of rocks exposed to the southward, it is manifest that the south-eastern is by far the prevailing wind.

The north side of the island forms a large bight, in which the water is quite smooth, so that a boat can go close up to the cliffs, but on the southern and eastern sides a heavy sea dashes against the rocks.

The *Flying-Fish* steamed close round the island looking for anchorage, but found none, except in a small cove two miles to the westward of the north point of the island—this has been named Flying-Fish Cove; here she anchored in 22 fathoms, with her stern secured by hawsers to the trees, to prevent slipping off the bank.

The hill rises nearly perpendicularly at the head of the cove in the form of a horseshoe, and slopes gradually down to the two arms forming the cove. The bare beach is not more than 20 yards wide, and, from the look of the fragments that compose it, must be thrown up in northerly gales; the upper part of the beach to the foot of the hill, a distance of some hundred yards, is of just the same material, viz. fragments of coral rock and coral limestone, but it has a covering of mould from fallen leaves, and is thickly wooded, many of the trees on it being forest trees of 12 feet girth and of great height, apparently hundreds of years of age, showing that a very long time must have elapsed since that beach was raised from the water.

One very large tree had something like the letters **W W** cut inside a scroll, and nearly illegible from time; this was the only sign of the island having been visited before; but one of our officers heard at Batavia that a Dutch vessel was wrecked on the south-east point of the island in a calm about fifteen years ago, and that the crew escaped and lived many months on the island before they were taken off, but I have no other details about the affair.

No running water was seen, but the droppings from the leaves during rain and dew must be great, as holes in the rocks and cup-shaped leaves were filled with water. As it was raining over some part of the island (generally the western) great part of the time the *Flying-Fish* was in the neighbourhood, and clouds were continually being formed over the island from the moist air driven up the side by the south-east wind, a great deal of water must be deposited, and probably be absorbed by the soil. At the eastern end of the cove, among the trees, where had seemed at first the most likely place for a watercourse, a few volcanic stones were found, but everywhere else the only rock seen was coral limestone; the cliffs above from which detached pieces had fallen to the beach were the same; the soil under the trees was a rich moist mould, apparently formed from decaying vegetation.

Landing was also effected at another small beach in the northern bight near the north-west point; the general features were the same, but there was no anchorage at half a cable from the shore. A few cocks and hens were landed here, but as the crabs immediately began to chase them, I doubt if they will survive and produce.

No large animals were seen, nor marks of any. An iguana, said to be 4 feet in length, was seen in a tree, high up, but was not captured. Rat-holes were numerous, and one rat was secured, also a large bat. Several insects, spiders, flies, beetles, and butterflies, were collected; there were sand-flies, but no mosquitoes. Large crabs were very plentiful, and appeared equally at home running over the sea-cliffs and climbing up the trees; they were very ravenous, pouncing quickly on a dead gannet and devouring other injured crabs, and they must be terrible enemies to the birds generally.

Gannet and frigate-birds frequent the island, and evidently breed there, but it was not the breeding-season, and very few eggs were found; the young birds were nearly grown. Besides the sea-birds there was the large green Torres Strait pigeon: one was shot, with three large red berries in his crop. These pigeons seemed to frequent the higher trees well up the hill. Also a ground-thrush, of a sooty-brown colour, just the colour of the fallen leaves among which it ran nimbly, apparently looking for insects; and a little fly-catcher of the same sombre colour. As evening advanced, a small swift appeared, which flew about the jungle on the margin of the beach, fly-catching: none of these three last were secured. No bones were found on the beach, nor remnant of any animal; not even turtle-remains.

The flora appeared to be the same as that of the neighbouring islands, the Moluccas. As before stated, the island is densely wooded, and many of the trees attain great size. Chief amongst them I recognized two iron-wood trees, one with straight stem and round trunk, and the other with strong buttresses from the roots; both are natives of Celebes. Creepers were as thick as in the Moluccas, and covered the top branches of the trees.

Two palms—one I take to be the sago-palm, growing to a great height; and the pandanus—were abundant: cocoa-nut trees were not seen, though husks were found on the beach, apparently washed up from elsewhere. At a small beach on the eastern side there appeared to be banana-trees, but they looked withered and there were no signs of fruit.

No mangroves were seen: the flora of the coast was generally such as is found in all tropical islands.

I regret to say that nearly all the botanical specimens that were collected were destroyed by insufficient drying in the exceedingly damp weather we experienced.

(Signed) J. P. MACLEAR,
Captain.

NOTES.

ON March 9, on the invitation of the Chief Justice of Queensland, a public meeting was held at Brisbane, to consider the establishment of a University for that colony. A resolution was

passed inviting ministers of religion, the various professions, and every representative body to petition Parliament to establish a University for Queensland in perpetual commemoration of the Jubilee year of the Queen's reign. A Committee was appointed to prepare a petition and make arrangements for united action.

ACCORDING to the *Calcutta Englishman*, the Indian Government has arranged a scheme for the complete and systematic botanical survey of India. The country will be divided into four great districts, the first under Mr. Duthie, Superintendent of the Government Botanical Gardens at Saharunpur; the second under Surgeon-Major King, Superintendent of the Royal Botanical Gardens at Calcutta; and the third and fourth under the Madras and Bombay Government Botanists respectively.

THE rich flora of the Philippine Islands has hitherto been most imperfectly known. In fact, it has been practically only represented in European herbaria by the collections of Cuming, which, though rich, were made in a limited area. It was only, therefore, to be expected that the explorations made by Dr. Sebastian Vidal, of Soler, Director of the Botanic Garden at Manilla, and of the Commission for studying the forest flora, would add to our knowledge a profusion of new and interesting species. Dr. Vidal has on two occasions visited Kew with his collections, which have quite realised the expectations that had been formed of them. There was some reason to fear that the work might, on financial grounds, have to be interrupted. But from a communication made to Kew by the Spanish Minister, we are glad to learn "that although the Botanical Survey Commission intrusted to Dr. Sebastian Vidal had been at one time suppressed in the Budget of 1887–88, it was afterwards re-established in view of the great importance of the work."

THE thirty-sixth meeting of the American Association for the Advancement of Science will be held in New York during the week beginning August 10, 1887. The New York Academy of Sciences has appointed a Committee to secure concert of action among those who are anxious that adequate preparations may be made for the meeting.

IN his speech at the Royal Academy banquet, Prof. Huxley offered some suggestive and interesting remarks on the relations between science on the one hand and art and literature on the other. "I imagine, he said, "that it is the business of the artist and of the man of letters to reproduce and fix forms of imagination to which the mind will afterwards recur with pleasure; so, based upon the same great principle by the same instinct, if I may so call it, it is the business of the man of science to symbolize, and fix, and represent to our mind in some easily recallable shape, the order, and the symmetry, and the beauty that prevail throughout Nature. I am not sure that any of us can go much further from the one to the other. We speak in symbols. The artist places his colours upon the wall; the colours have no relation to the actual objects, but they serve their purpose in recalling the emotions which were present when the scenes which they depict were acted. I am not at all sure that the conceptions of science have much more correspondence with reality than the colours of the artist have; but they are the symbols by which we are constantly recalling the order and beauty of Nature, and by which we by degrees force our way further and further into her penetralia, acquiring a greater insight into the mystery and wonder which are around us, and at the same time, by a happy chance, contributing to the happiness and prosperity of mankind." Referring to the fact that in these days scientific men are in danger of becoming specialists, occupied with a comparatively small field, Prof. Huxley maintained that the remedy lies in the recognition of "the great truth that art and literature and science are one, and that the foundation of every sound education and preparation for active life in which a special education is necessary should be some efficient training in all three." He concluded as follows:—"I sincerely trust, Sir, that, pondering upon these matters, understanding that which you so freely recognise here, that the three branches of art and science and literature are essential to the making of a man, to the development of something better than the mere specialist in any one of these departments—I sincerely trust that that spirit may in course of time permeate the mass of the people, that we may at length have for our young people an education which will train them in all three branches, which will enable them to understand the beauties of art, to comprehend the literature at any rate of their own country, and to take such interest not in the mere acquisition of science, but in the methods of inductive logic and scientific inquiry as will make them equally fit, whatever specialised pursuit they may afterwards take up. I see great changes; I see science acquiring a position which it was almost hopeless to think she could acquire. I am perfectly easy as to the future fate of scientific knowledge and scientific training; what I do fear is, that it may be possible that we should neglect those other sides of the human mind, and that the tendency to inroads which is already marked may become increased by the lack of the general training of early youth to which I have referred."

THE first edition of "Scenery of Scotland viewed in Connexion with its Physical Geology," by Mr. Archibald Geikie, was published twenty years ago. It was one of the first books in which the origin of the scenery of a country was traced out in some detail with reference to geological structure. Since the appearance of the work, the author has extended his experience by journeys all over Europe and through the western territories of America, and he is engaged, we understand, upon a general treatise on the origin of the surface features of the land. In the meantime, in response to repeated requests, he has prepared a new edition of his first work on the subject—the "Scenery of Scotland." The book has been thoroughly revised and in great part re-written. The illustrations are almost all new. It is expected that the volume will be ready in time for the visitors who crowd into Scotland in the summer and autumn.

MESSRS. KEGAN PAUL, TRENCH, AND CO., will publish immediately "Three Lectures on the Anatomy of Movement: a Treatise on the Action of Nerve Centres and Modes of Growth," delivered at the Royal College of Surgeons by Dr. Francis Warner, Hunterian Professor of Comparative Anatomy and Physiology.

REGULARLY during twenty-five years, on the first of each quarterly month, Mr. Van Voorst published a part of Hewitson's "Exotic Butterflies," containing coloured figures of new species. The work was completed a few years ago. Since that time, material for its continuation has accumulated in the collection of Mr. Henley Grose Smith, who will now, with the assistance of Mr. W. F. Kirby, bring out another series under the title of "Rhopalocera Exotica." Part 1 will be published by Mr. Van Voorst's successors, Messrs. Gurney and Jackson, in July.

In continuation of Hooker and Baker's "Synopsis Filicum," a hand-book of the other orders of Vascular Cryptogamia, by Mr. J. G. Baker, will be published shortly by Messrs. G. Bell and Son. It will include Equisetaceæ, Fycopodiaceæ, Selaginellaceæ, and Rhizocarpeæ, in which, excluding the fossil types, there are eleven genera and about 700 species.

MR. ARTHUR DENDY, B.Sc. of the Victoria University, and Associate in Science of Owens College, has been appointed by the Trustees of the British Museum an Assistant in the Department of Zoology in the vacancy occasioned by the resignation of Mr. Stewart O. Ridley, whose work in connexion with

the sponges and corals Mr. Dendy will continue. The vacancy in the Botanical Department occasioned by Mr. Fawcett's appointment to the Curatorship of the Botanical Gardens in Jamaica has been gained, after competitive examination, by Mr. Edmund Gilbert Baker, a son of the well-known botanist of Kew Gardens.

THE Council of the British Medical Association have recently appointed Mr. Watson Cheyne and Dr. Sidney Martin as Science Scholars for one year. The former proposes to continue his research of Bacteria in relation to disease, and the latter to carry on researches on the vegetable albuminoses, especially with relation to their alleged toxic action.

ON Monday last, Mr. J. M. Thomson delivered the first of the concluding course of Cantor Lectures at the Society of Arts. The remaining lectures of the course will be delivered on May 9, 16, and 23. The subject is the "Chemistry of Substances taking Part in Putrefaction and Antisepsis."

ANOTHER synthesis of a natural product has just been added to the long score of successes which have followed Wöhler's initiative. About a dozen years ago it was observed that the outer coatings of walnuts collected at the end of June became covered with small yellow needle-shaped crystals, of a substance which was found by Vogel and Reischauer in the expressed juice of the same, and named by them nucine or juglon. Bernthsen and Semper have very recently (*Ber. Deut. Chem. Ges.* 1887, No. 6) proved conclusively that this substance is an α-hydroxy-α-naphthoquinone, $C_{10}H_5O_2(OH)$, and to complete the proof have actually built up the same substance directly from naphthalene. They first prepared $\alpha_1\ \alpha_3$ dihydroxynaphthalene, $C_{10}H_6(OH)_2$, by Armstrong's method, which was then oxidized by chromic acid; the brown precipitate obtained was afterwards digested with warm ether, and after removal of the ether by distillation, crystallization from chloroform yielded beautiful acicular crystals identical in all respects with juglon, of nutshell odour, producing violent sneezing. As naphthalene itself can be built up from its elements, it follows that juglon, undoubtedly a product of vegetable growth, has been synthetized by artificial means.

SOME important observations on the structure and origin of the gelatinous sheath which invests the filaments of many Algæ, and also some Flagellata, have recently been published by Herr G. Klebs. In the Zygnemaceæ this sheath is composed of a substance entirely independent of the cell-walls. It consists of two portions: a homogeneous substance which is but slightly refringent, and which is indifferent to the action of staining reagents; and a portion which absorbs pigments with avidity, and which is composed of minute rods at right angles to the cell-wall. This substance does not exhibit the reactions of the ordinary mucilage of vegetable cells; it is not dissolved by alkalies. The author maintains that the substance of the sheath is derived directly from the cytoplasm of the cell through the cell-wall; it is always quite distinct from the cell-wall, and must be formed by apposition rather than by intussusception. Similar results were obtained from the gelatinous sheath of the Desmidieæ and of some other Algæ. A gelatinous sheath can be detected in nearly all the Flagellata by the use of sufficiently dilute staining materials; and here, also, the sheath is due directly to the activity of the protoplasm. In *Euglena sanguinea* it is secreted in the form of more or less curved filamentous bodies. In the social forms the gelatine consists of a fundamental substance, immersed in which are denser granular corpuscles. The brown or black colour is due to the deposition of oxide of iron.

THE preparations for the making of a canal between the Baltic and the German Ocean are so far advanced that the construction of the earthworks will be begun on June 18.

ON March 17 we stated in a note that the Berlin Academy of Sciences had granted a sum of money "for the printing of some important zoological works," among which we mentioned Dr. Taschenberg's "Bibliothek." Herr Engelmann, the publisher of the "Bibliothek," writes to us that the grant was made to Dr. Taschenberg personally, in recognition of his labours as editor, and that it does not in the slightest degree diminish the publisher's responsibilities in connexion with the work.

THE Council of the Parkes Museum believe that there are many medical men who would be glad to make use of the Museum under the guidance of someone able to point out the object and advantages of the various appliances exhibited. They have therefore arranged, for the month of May, three demonstrations, which will be open to all members of the medical profession on presentation of their cards. Prof. W. H. Corfield has consented to give a demonstration on Monday, May 9; Mr. Rogers Field on Monday, May 16; and Mr. Percival Gordon Smith on Monday, May 23. The demonstrations will begin at 5 p.m.

SIX years ago a seaside laboratory for the study of biology was started at Annisquam, near Cape Ann, by the American Woman's Education Association. The Society, which does not give permanent support to any of its enterprises, has always been anxious that this institution should be placed on a secure basis; and accordingly a circular letter was lately sent to teachers of science in different parts of the United States, giving an account of the work done, and asking for opinions as to the need of such an establishment. The answers were so satisfactory that a number of naturalists met to consider the question; and this meeting appointed a Committee with full power to establish a new and greatly improved laboratory. An appeal for 15,000 dollars has now been issued, and if the response is liberal, the laboratory may be opened in the summer of the present year.

THE Italian Meteorological Society reports that its observer at Patagones (lat. 40° 49′ S., long. 62° 45′ W.), while taking observations at 2 a.m. on December 1 last—observations being then taken every two hours—was surprised by a continuous shower of innumerable shooting-stars proceeding from all visible parts of the sky. They were of varying brilliancy, the majority appearing to be of the brightness of stars of the second and third magnitude. He was unable to take an exact observation, for want of necessary materials; but during the fifteen or twenty minutes that he stood observing them, the stupendous display constantly maintained the same intensity.

M. L. TEISSERENC DE BORT has published in *Ciel et Terre* a summary of his charts showing the mean amount of cloud over the surface of the globe, presented to the Académie des Sciences, Paris, on February 7. The paper is of interest from the fact that up to the present time the amount of cloud has not been treated in the same general way as the other meteorological elements, except for limited areas. The charts in question are based on observations made at 700 stations, and on an immense number of observations collated by the Meteorological Office in Paris. The following are the principal conclusions arrived at: (1) there is a marked tendency in all months towards a distribution of cloud in zones parallel to the equator; (2) when disturbing influences are eliminated it is seen that there is a maximum amount of cloud near the equator, that there are two belts of slight nebulosity from 15° to 35° of north and south latitude, and two zones of greater cloudiness between latitudes 45° and 60°, and that beyond this (so far as can be judged from observations in the northern hemisphere) the sky appears to become clear towards the Poles; (3) these zones have a marked tendency to follow the march of the sun's declination; they are transferred towards the north in

spring, and towards the south in autumn; (4) if the charts of nebulosity are compared with isobaric and wind charts it will be seen that the zones of clear sky correspond to the regions of high pressure which lie on each side of the equator, and which give rise on the one hand to the trade winds, and, on the other, to the westerly winds which prevail towards the temperate regions of the two hemispheres. The zones of greater cloudiness extend above the regions of low pressures, viz. near to the equator, on the one hand, and near to 60° of north and south latitude. The distribution of cloud, taken as a whole, appears therefore to be a direct result of the march of the winds, and is regulated by the distribution of the atmospheric pressures.

THE new Industrial Institute at Bromley, Kent, was opened on Saturday last by Sir Lyon Playfair. Hitherto, he said, the country had prided itself upon the practical knowledge of its artisans, but it had relied too entirely upon that knowledge, and the consequence had been that countries which nurtured the intellects of their people had stepped in, and with their superior mental education had shown the world that the competition of the day was not one of local advantages, such as the possession of raw material applicable to industries, but a competition of intellect. England was realizing her position now, and training her sons by technical schools to compete intellectually with the countries round her, from whom she had learnt her lesson.

Science lately invited certain eminent American authorities on education to discuss in its columns the question, "What industry, if any, can profitably be introduced into country schools?" Mr. Samuel G. Love writes enthusiastically on the effects which may be produced on children by industrial or manual training. It "opens a way," he thinks, "to interest them, to develop and employ their perceptive faculties, and to make the otherwise unattractive experiences of school life cheerful and pleasant." As for the particular kinds of industry that may be most advantageously introduced, he contents himself with the general statement that "there are many things that can be done with profit in any and all schools; and, as soon as the pupil enters upon school life, one of them should be taken up, and each carried forward one after the other, just as the subjects of study are taken up and completed." Mr. Francis A. Walker is more precise. He proposes that approved methods of the Kindergarten should be carried upwards through the primary grades; that at the age of twelve, or thereabouts, there should be semi-weekly exercises with tools, preferably wood-working tools, and in clay-modelling; and that at the age of about fourteen, exercises in metal-working should be begun. Mr. Charles H. Ham takes a wholly different view. He objects to the introduction of "industrial features" into courses of popular education in rural districts, partly because industrial training is very costly, but chiefly because children in the country learn so many things in their ordinary work and play that they do not seem to him to need any special industrial training at school.

THE additions to the Zoological Society's Gardens during the past week include two Green-winged Doves (*Chalcophaps indica*) from Penang, presented by Mr. S. A. Clarke; two Alpine Newts (*Molge alpestris*) from Algiers, presented by Mr. Alban Doran; twenty Ruffe or Pope (*Acerina cernua*) from British fresh waters, presented by Mr. T. E. Gunn; a Whinchat (*Pratincola rubetra*), British, two White-faced Tree-Ducks (*Dendrocygna viduata*) from Brazil, purchased; two White-necked Storks (*Dissura episcopus*) from West Africa, two Demoiselle Cranes (*Grus virgo*) from North Africa, received in exchange; a Gayal (*Bibos frontalis* ♂), a Persian Gazelle (*Gazella subgutterosa* ♂), born in the Gardens.

OUR ASTRONOMICAL COLUMN.

THE ORBIT OF THE MINOR PLANET EUCHARIS.—Dr. L. de Ball has published, in *Mémoires de l'Académie Royale de Belgique*, tome xlix., an investigation of the orbit of *Eucharis* (No. 181), deduced from all the available observations made during the years 1878 (the year of its discovery) to 1886 inclusive. The discussion of the orbit of this minor planet is of considerable interest, as in part of its path it approaches Jupiter, and its consequent perturbations will afford material for a determination of the mass of that planet. To attempt such a determination at present would be premature, but a necessary preliminary to it is the determination of a sufficiently accurate orbit for the perturbed planet, and this is furnished by Dr. de Ball in the paper before us. The perturbations due to Jupiter and Saturn, using Bessel's values of the masses, have been taken into account, and great pains have been taken to reduce the places of the comparison-stars used to a uniform system—that of Auwers's Fundamental Catalogue. The great mass of observations discussed in this paper are equatorial observations; a considerable number of meridian observations made with the Washington transit-circle in 1878 are, however, also discussed. These do not harmonize very well with the equatorial observations, and Dr. de Ball is led to the conclusion (for which he is unable to account) that the corrections to reduce the Washington meridian observations to the system of the Fundamental Catalogue deduced from fundamental stars are not applicable to the observations of *Eucharis*, and gives the latter consequently a very small combining weight. But this want of harmony it doubtless due to the circumstance that the observations of fundamental stars are made in a bright field, whilst those of the planet must have been made in a dark field with illuminated threads—a difference which is quite sufficient to account for such a systematic discordance as Dr. de Ball has found to exist.

ASTRONOMICAL PHENOMENA FOR THE WEEK 1887 MAY 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 May 8.

Sun rises, 4h. 22m.; souths, 11h. 56m. 20·1s.; sets, 19h. 31m.; decl. on meridian, 17° 5′ N.: Sidereal Time at Sunset, 10h. 36m.

Moon (at Last Quarter on May 14) rises, 7h. 24m.*; souths, 0h. 26m.; sets, 5h. 19m.; decl. on meridian, 13° 41′ S.

Planet.	Rises. h. m.	Souths. h. m.	Sets. h. m.	Decl. on meridian. ° ′
Mercury ...	3 56	10 43	17 30	8 29 N.
Venus ...	6 1	14 30	22 59	25 10 N.
Mars ...	4 16	11 44	19 12	16 2 N.
Jupiter...	17 30	22 44	3 58*	9 42 S.
Saturn...	8 5	16 13	0 21*	22 17 N.

* Indicates that the rising is that of the preceding evening and the setting that of the following morning.

Variable Stars.

Star.	R.A. h. m.	Decl. ° ′			h. m.	
U Cephei ...	0 52·3	81 16 N.	...	May 9,	3 19	*m*
				,, 14,	2 59	*m*
U Monocerotis ...	7 25·4	9 33 S.	...	,, 9,		*M*
W Virginis ...	13 20·2	2 48 S.	...	,, 12,	2 0	*m*
δ Libræ ...	14 54·9	8 4 S.	...	,, 14,	3 36	*m*
U Coronæ ...	15 13·6	32 4 N.	...	,, 14,	19 50	*m*
S Libræ ...	15 14·9	19 59 S.	...	,, 13,		*m*
U Ophiuchi...	17 10·8	1 20 N.	...	,, 9,	3 22	*m*
		and at intervals of			20 8	
U Sagittarii...	18 25·2	19 12 S.	...	May 8,	20 0	*m*
R Scuti ...	18 41·3	5 50 S.	...	,, 13,		*M*
η Aquilæ ...	19 46·7	0 43 N.	...	,, 8,	0 0	*M*
S Sagittæ ...	19 50·9	16 20 N.	...	,, 14,	1 0	*m*
U Cygni ...	20 16·1	47 32 N.	...	,, 13,		*m*
W Cygni ...	21 31·8	44 52 N.	...	,, 9,		*M*
S Cephei ...	21 36·6	78 7 N.	...	,, 13,		*m*
δ Cephei ...	22 25·0	57 50 N.	...	,, 10,	0 0	*m*

M signifies maximum; *m* minimum.

Occultations of Stars by the Moon (visible at Greenwich).

May.	Star.	Mag.	Disap.	Reap.	Corresponding angles from vertex to right for inverted image.
			h. m.	h. m.	° °
8	γ Libræ ..	4½	1 4	near approach	168 —
13	π Capricorni	5	3 35	4 57	93 274

GEOGRAPHICAL NOTES.

In the new number (iv.) of *Petermann's Mitteilungen* we find an interesting note by General Tillo on what he calls the chief water-partings of the earth. He points out that it is usual to indicate for each region the great water-partings, and to come down from that to what are considered as smaller or subordinate water-partings. But it seems to him that, from a general consideration of the earth's surface, the idea of a great world-water-parting may be worked out. This he illustrates by a Polar projection map in which the Old and the New World continents are brought face to face. On this he lays down one continuous line, broken only by Bering's Straits, extending from the south point of America, north along the west side of South and North America, in an irregular diagonal across Asia to the Isthmus of Suez, and down Eastern Africa to the Cape. No doubt there is much to be said for this general conception, especially as General Tillo admits that there are special continental water-partings which do not quite conform to the line of the great parting, though, as a matter of fact, nearly all the great rivers of the world are divided by this parting into two directions. It brings out strikingly the fact that the greater portion of the land-mass of the Old World, and by far the larger portion of the New World are drained into the Polar Atlantic basin.

Among the other papers in the new number of *Petermann* is one on the caravan routes between Suakim and Kassala, by Josef Menges. Dr. Ed. Petri contributes a paper of great interest containing some fresh and curious data on the Yakuts, of whose persistence, activity, and culture, he, like others, has formed a high estimate. Dr. Posewitz contributes a first paper on the geological condition of the Island of Billiton, with special reference to mining.

M. Chaffaujon has completed his exploration of the Orinoco and returned to Ciudad Bolivar. He states, in a letter dated March 15 last, that he has discovered the sources of the Orinoco, and found that the River Cassiquiari is only a branch of that river, uniting its basin with that of the Amazon; which seems pretty much what we knew before. M. Chaffaujon has sent a complete report of his exploration to the French Minister of Public Instruction, as well as some ethnographical curiosities, and a fairly complete collection of the fishes of the Orinoco.

At a recent meeting of the Hungarian Geographical Society, Herr Moriz Von Déchy gave an account of his exploration of the Caucasus last year, in company with the geologist Dr. Schafurzik. The exploration has been rich in scientific results. Besides taking numerous observations on glaciers, measurements of heights, and many fine photographs, the explorers have brought back with them large collections, which have been deposited in the Museum of the Society, the University of Buda-Pesth, and the Hungarian Geological Institute. There are eighteen boxes of rocks and minerals. There is a small collection of beetles, and several highly interesting and valuable macrocephalic skulls. These, with the large collection of plants obtained in the Expedition of 1885, will be of the highest value to writers on the geology and natural history of this interesting region.

It is stated in Copenhagen that an Expedition will be despatched late this summer by Herr A. Gamil, the equipper of the *Dijmphna* Expedition of 1882, to the north-east coast of Greenland. It is hoped that the explorers may reach a higher latitude than that attained by Lieut. Holm in 1884, and discern the "Sound" described by the East Greenlanders as running from the east to the west coast, somewhere in latitude 78° N. The Expedition will, if it starts, be commanded by Lieut. Hovgaard, who in 1882 commanded the *Dijmphna*.

France has succeeded in moving the eastern boundary of her Congo territory from the somewhat uncertain River Licona to the magnificent Mobangi. According to the *Times* Paris Correspondent, the *Thalweg* of the Mobangi is to be the boundary between the French territories and the Congo Free State; but how far up the Mobangi the boundary goes we are not informed. As, by the Berlin Treaty, we understand France cannot go farther north than 4° N. lat., we do not see that she gains much by this new boundary, should the Mobangi turn out, as is probable, to be identical with the Wellé. Had the Paris Correspondent taken the trouble to look at a map, he would not have told us that by this new advance France becomes mistress of the greater part of the Congo basin; the statement is absurd.

We are glad to learn of the safety of Mr. Carey, to whose extensive journeys in Central Asia we referred in a previous number. He has wintered at Hami, and is by this time probably well on his way to India.

Those interested in Dr. Junker will find a very full statement of his work, with a map, in the new number of the Proc. R.G.S., by Mr. J. T. Wills. Dr. Junker's travels in the Soudan and Central Africa have lasted from the spring of 1876 to the end of 1886, with the exception of about a year and a half in 1878–80. In his first journey he found the sources of the Wellé-Makua near Lake Albert Nyanza. In 1880–83 he explored the basin of the Makua and Kuta (probably the Upper Mobangi).

The Government of Victoria are preparing to send out a well-equipped expedition to explore the Owen Stanley Range of New Guinea, from Port Moresby, and have, we learn from the Proc. R.G.S., offered the leadership to the man of all others best able to carry out so difficult an undertaking to a successful issue—the Rev. J. Chalmers.

A further step has been taken in promotion of an expedition towards the South Pole, by the colony of Victoria. Acting on an offer made by Sir Allen Young to lead such an expedition, it is stated that Sir Graham Berry has brought the question of a Government grant towards the cost of the enterprise before the Victorian Cabinet, and that the matter is being urged forward with a view to the expedition starting from Hobson's Bay in October or November next.

THE WORK OF THE IMPERIAL INSTITUTE.[1]

II.

While extolling the comprehensive and well-organised sytems of technical education existing in all parts of the Continent and the United States, let us not undervalue the great progress which has been made in recent years in Great Britain in the advancement and extension of technical instruction. The Royal Commission on the Depression of Trade and Industry state, as the result of evidence collected by them, that "It would be difficult to estimate the extent to which our industries have been aided in various ways by the advance of elementary, scientific, and technical education during the last twenty years."

The important influence exercised by the admirable work which the organisation of the Science and Art Department has accomplished, upon the intellectual and material progress of the nation, is now thoroughly recognised. Prof. Huxley, the Dean of the Normal School of Science, in his recent important letter "On the Organisation of Industrial Education," has reminded us that "the classes now established all over the country in connexion with that Department, not only provide elementary instruction accessible to all, but offer the means whereby the pick of the capable students may obtain in the schools at South Kensington as good a higher education in science and art as is to be had in the country," and "that it is from this source that the supply of science and art teachers is derived, who in turn raise the standard of elementary education" provided by the School Boards. The extension of facilities for the education of those engaged in art-industries is constantly aimed at, as was recently demonstrated by the creation of free studentships for artisans in the Art Schools at South Kensington.

The necessity which has gradually made itself felt in the manufacturing towns of the United Kingdom for encouraging the study of science in its application to industries, by those who intend to devote themselves to some branch of manufacture or trade, has led to the establishment in about twenty-five towns in England and Scotland, and in two or three in Ireland, of colleges of science corresponding more or less to the Continental

[1] Lecture (abridged) delivered at the Royal Institution, on Friday, April 22, by Sir Frederick Abel, C.B., F.R.S.; H.R.H. the Prince of Wales, K.G., F.R.S., Vice-Patron, in the Chair. Continued from vol. xxxv. p. 621.

polytechnic schools, and accomplishing important work in training students in the different branches of science in their applications to manufactures and the arts.

The wealthier of the City Companies, some of which had long been identified with important educational establishments, associated themselves with the Corporation of the City of London nearly ten years ago to establish an organisation for the advancement of technical education, which has already carried out most important work. The Society of Arts, which initiated the system of examinations, afterwards so successfully developed by the Science and Art Department, set on foot and conducted for several years examinations of artisans in a few branches of technology. This useful work was relinquished in 1879 to the City and Guilds Institute, and its gradual extension since that period has been attended with most satisfactory results. The beneficial influence exercised by the examinations upon the development and extension of technical instruction in the manufacturing districts throughout the country being already very marked. The adoption of the system, originated by the Science and Art Department, of contributing to the payment of teachers in proportion to the successes attained by their pupils, is operating most successfully in promoting the establishment and extension of classes for instruction in technical subjects, in connexion with Mechanics' Institutes and other educational establishments in various centres of industry.

The Technical College at Finsbury was the first great practical outcome of the efforts made by the City and Guilds Institute to supplement existing educational machinery, by the creation of technological and trade schools in the metropolis, and the results, in regard to number and success of students at the day and evening schools of that important establishment, have afforded conclusive demonstration of the benefits which it is already conferring upon young workers who, with scanty means at their command, are earnest in their desire to train themselves thoroughly for the successful pursuit of industries and trades. The evening courses of instruction are especially valuable to such members of the artisan classes as desire, at the close of their daily labour, to devote time to the acquisition of scientific or artistic knowledge.

Another department of the City and Guilds Institute, of a somewhat different character, is the South London School of Technical Art, which is also doing very useful work, while the chief or Central Institution for Technical Education, which commenced its operations about three years ago, if it but continue to be developed in accordance with the carefully matured scheme which received the approval of the City and Guilds Council, and with that judicious liberality which has been displayed in the design and arrangement of the building, bids fair to become the Industrial University of the Empire.

As one of the first students of that College of Chemistry which became part-parent of our present Normal School of Science, and the creation of which (forty-two years ago) constituted not the least important of the many services rendered towards the advancement of scientific education in this country by His Royal Highness the Prince Consort, most vividly I remember the struggling years of early existence of that half-starved but vigorous offspring of the great school of Liebig, born in a strangely unsympathetic land in the days when the student of science in this country still met on all sides that pride of old England, the practical man, inquiring of him complacently: *cui bono? quo bono?* That ardent lover of research and instruction, the enthusiastic and dauntless disciple of Liebig—my old master—Hofmann, loyally supported through all discouragement, and in the severest straits, by a small band of believers in the power of scientific research to make for itself an enduring home in this country, succeeded in very few years in developing a prosperous school of chemistry which soon made its influence felt upon British industry; and it is not credible that less important achievements should be accomplished, and less speedily, in days when the inseparable connexion of science with practice has become thoroughly recognised, by an Institution created, and launched under most auspicious circumstances, by those powerful representatives of the commercial and industrial prosperity of the Empire, who, before all others, must realise the vital necessity for ceaseless exertions, even for much self-sacrifice in the immediate present, to recover our lost ground in the dominions of industry.

One of the most important functions of the Central Technical College should consist in the thorough training of teachers of applied science. The statistics furnished by the technological examinations show that, while their successful organisation has led to the establishment of classes of instruction, supplementary to the general science teaching in every large manufacturing centre, the increase in the number of candidates examined has been accompanied by an increase in the percentage of failures to pass the examinations, and that the supply of a serious deficiency in competent teachers was essential to a radical improvement in technical education. The work of the City and Guilds Institute in this direction has already been well begun, and it is in the furtherance of this, by the organisation of arrangements for facilitating the attendance of science teachers for sufficient periods at the Central Institute, or at more accessible provincial technical colleges, that the Imperial Institute may hope to do good work.

Without taking any direct part in the duty of education, it is contemplated that the Imperial Institute will actively assist in the thorough organisation of technical instruction, and its maintenance on a footing, at least of equality, with that provided in other countries, by the system of intercommunication which it will establish and maintain between technical and science schools; by the distribution of information relating to the progress of technical education abroad, to the progressive development of industries, and the requirements of those who intend to pursue them; by the provision of resources in the way of material for experimental work, and illustrations of new industrial achievements, and by a variety of other means.

The provision of facilities to teachers in elementary schools to improve their knowledge of science and their power of imparting information of an elementary character to the young, constitutes another direction in which important progress may be made towards establishing that continuity between elementary and advanced education which is so well developed on the Continent. The organisation of facilities, combined with material aid, to be provided to young artisans who shall afford some legitimate evidence of superior natural intelligence, and a striving after self-improvement, to enable them to abandon for a time the duty of bread-winning, and to work at one or other of the technical schools in London or the provincial centres, will be another object to which the resources of the Imperial Institute should be applied very beneficially. Not only will the intelligent workman's knowledge of the fundamental principles of his craft or trade be thereby promoted; his association in work and study with others who are pursuing the acquisition of knowledge in different directions, which at first seem to him alien to his personal pursuits and tastes, but come in time to acquire interest or importance in his eyes, will bring home to him the advantages of a wider and more comprehensive scope of instruction, and the enlargement of his views regarding the value and pleasure of knowledge will, in turn, exercise a favourable influence in the same direction upon those with whom he afterwards comes into contact. The cramping influence which the great subdivision of labour, resulting from the development of mechanical, physical, and chemical science, is calculated to favour, must thus become counteracted, and the workman will realise that if he is to rise above the level of the ordinary skilled labourer, mere dexterity in the particular branch of that trade which he has made his calling must be supplemented by an acquaintance with its cognate branches, by some knowledge of the principles which underlie his work, and by some familiarity with the trades allied to his calling.

The importance of bringing technical instruction within the reach of the needy scholars of the lower middle class need not be dwelt upon, and there can be no question that one of the most powerful means of promoting the extension of technical education will be the well-organised administration of a really comprehensive system of scholarships, to be judiciously utilised in connexion with the well-established colleges and schools of science and technics throughout the country, in such proportions as to meet local requirements and changing conditions. That a good foundation for such a system of scholarships is likely ere long to emanate from the resources of the Royal Commission of 1851, has already been officially indicated in one of its reports; may we not also hope that many will be found in our Empire ready to follow the example of the late Sir Joseph Whitworth, and to act in emulation of the patriotism of those men who, by munificent donations or endowments in aid of the work of bringing industrial education within the reach of all classes in the United States, have helped to place our cousins in the position to hold their own and aspire to victory, in the war of industry? The thoroughly representative character which it is

intended to maintain for the governing body of the Imperial Institute will secure the wise administration by it of funds of this kind, dedicated to the extension and perfection of national establishments for technical education, and to the encouragement of its pursuit, in the ways above indicated, by those whose circumstances would otherwise prevent them from enjoying the advantages secured to their fellow-workers in other countries. Several other directions readily suggest themselves in which the judicious administration of resources in aid of the technical training of eligible men of the the artisan class could well form part of the organised work of the Imperial Institute.

By the establishment of an Education branch of the Intelligence Department, which will form a very prominent section of the Imperial Institute, the working of the colleges and schools of applied science in all parts of the United Kingdom will be harmonised and assisted, and the information continuously collected from all countries relating to educational work and the application of the sciences to industrial purposes and the arts will be systematically distributed. A well-organised Inquiry Department will furnish to students coming to Great Britain from the colonies, dependencies, and India, the requisite information and advice to aid them in selecting their place of work and their temporary home, and in various other ways. The collections of natural products of the colonies and India, maintained up to the day by additions and renewals at the central establishment of the Institute, will be of great value to students in the immediately adjacent educational institutions, and will, moreover, be made subservient to the purposes of provincial industrial colleges by the distribution of thoroughly descriptive reference catalogues, and of specimens. Supplies of natural products from the Colonies, India, or from other countries, which are either new or have been but imperfectly studied, will be maintained, so that the material may be readily provided to the worker in science or the manufacturer, either for scientific investigation or for purposes of technical experiment.

The existence of those collections and of all information relating to them, as well as of the libraries of technology, inventions, commerce, and applied geography, in immediate proximity to the Government Museums of Science and Inventions, Art, and Natural History, to the Normal School of Science, and to the Central Technical Institute, present advantages so obvious as to merit some fair consideration by those who have hitherto declined to recognise any reason in favour of the establishment of the Imperial Institute at South Kensington.

In the powerful public representations which have of late been made on the imperative necessity for the greater dissemination and thorough organisation of industrial education, the importance of a radical improvement in commercial education, as distinguished from what is comprehended under the head of technical training, has scarcely received that prominence which it merits. It is true that, in some of our colleges, there are courses of instruction framed with more especial reference to the requirements of those who propose to enter into mercantile houses, or in other ways to devote themselves to commercial pursuits; but as a rule the mercantile *employés*, embraced under the comprehensive title of clerks, begin their careers in life but ill prepared to be more than mechanical labourers, and remain greatly dependent upon accident, or upon their desire for self-improvement which directs them in time to particular lines of study, for their prospects of future success in commercial life.

This impressed itself strongly upon the Royal Commission on the Depression of Trade and Industry, who state as the result of evidence collected by them that our deficiency in the matter of education as compared with some of our foreign competitors relates "not only to what is usually called technical education, but also to the ordinary commercial education which is required in mercantile houses." The ordinary clerk in a merchant's office is too often made to feel his inferiority to his German colleague, not merely in regard to his lamentable deficiency in the knowledge of languages, but in respect to almost every branch of knowledge bearing upon the intelligent performance of his daily work and upon his prospect of advancement. The preliminary training for commercial life on the Continent is far more comprehensive, practical, and systematic than that which is attainable in this country, and the student of commerce abroad has, afterwards, opportunities for obtaining a high scientific and practical training at distinct branches of the polytechnic schools and in establishments analogous to the technical colleges such as the High Schools of Commerce in Paris, Antwerp, and Vienna.

It will be well within the scope of the Imperial Institute, as an organisation for the advancement of industry and commerce, to promote a systematic improvement and organisation of commercial education by measures analogous to those which it will bring to bear upon the advancement of industrial education.

The very scant recognition which the great cause of technical education has hitherto received at the hands of our administrators has, at any rate, the good effect of rousing and stimulating that power of self-help which has been the foundation of many achievements of greatest pride to the nation, and we may look with confidence to the united exertions of the people of this country, through the medium of the representative organisation which they are now founding, for the early development of a comprehensive national system of technical education, of the nature foreshadowed not long since by Lord Hartington, in that important address which has raised bright hopes in the hearts of the apostles of education.

In connexion with some of the views which have been of late put forward regarding the possible scope of the Imperial Institute, the antagonism which has been raised and fostered against its location in the vicinity of some of our national establishments most intimately connected with the educational advancement of the Empire, has developed a tendency to circumscribe its future sphere of usefulness, and to place its functions as a great establishment of reference and resort for the commercial man in the chief foreground. I have endeavoured to indicate directions in which its relations to the Colonies and India, to the great industries of the country, and to the advancement of technical and commercial education, cannot fail to be at least as important as its immediate connexion with the wants of the commercial section of the community, and those are most certainly quite independent of the particular locality in which it may be placed, excepting in so far as the command of ample space, and the advantages to be derived from juxtaposition with the great national establishments to which I have referred, is concerned. At the same time, there is not one of the directions in which the development of the resources and activity of the Institute has been thus far indicated, which has not an immediate and important bearing upon the advancement of the commerce of the Empire. There are, however, special functions to be fulfilled by the Institute, which are most immediately connected alike with the great commercial work of the City of London and with that of the provincial centres of commerce. The provision, in very central and readily accessible positions, of commercial museums or collections of natural or import products, and of export products of different nations, combined with comprehensive sample-rooms and facilities for the business of inspection, or of commercial, chemical or physical examination, is a work in which the Institute should lend most important aid. The system of correspondence with all parts of the Empire which it will develop and maintain will enable it to collect and form a central depot of natural products from which local commercial museums can be supplied with complete, thoroughly classified economic collections, and with representative samples of all that, from time to time, is new in the way of natural products from the Colonies and Dependencies, from India, and from other countries. In combination with this organisation, the distribution to commercial centres of information acquired by a central department of commercial geography will constitute an important feature in the work of the Institute, bearing immediately upon the interests of the merchant at home, in the Colonies, and in India.

The formation of specially commercial institutions, of which inquiry offices, museums, and sample-rooms with their accessories, will form a leading feature, and which will supply a want long since provided for by the nations with whom we compete commercially, is already in contemplation in the Cities of London and Newcastle; other great commercial centres will also doubtless speedily take steps to provide accommodation for similar offshoots from the central collections of the Institute. So far as the Indian Empire is concerned, the organisation of correspondence by provincial committees which already exists in connexion with economic and geological museums established in the several Presidencies, affords facilities for the speedy elaboration of the contemplated system of correspondence in connexion with the Institute, and the establishment of similar organisations in the different Colonies will, is is hoped, be heartily entered upon and speedily developed.

The system of correspondence to which I have more than once alluded in indicating some of the work of the Institute, in relation to technical education and industry, and which will form

a most important part of the main groundwork of its organisation, is not in the least theoretical in its character. Its possible development has suggested itself to many who have given thought to the future sphere of action of the Institute in connexion with commerce and industry; to myself, who for many years have been, from time to time, officially cognisant of the work performed by what are called the Intelligence Departments of the Ministries of War abroad and at home, the direct and valuable bearing of such a system upon the work of the Institute, suggested itself as soon as I gave thought to the possible future of this great conception, and to Major Fitzgerald Law belongs the credit of suggesting that the well-tried machinery of the War Office Intelligence Department should serve as a guide for the elaboration of a Commercial Intelligence Department. This Department, which will, it is hoped, ere long commence its operations by establishing relations with the chief colonies and India, will be in constant communication with the Inquiry Offices to be attached to the local commercial establishments and to other provincial representations of the work of the Institute, systematically distributing among them the commercial information and statistics continually collected. It will be equally valuable to the colonies and India by bringing their requirements thoroughly to the knowledge of the business men in the United Kingdom, and by maintaining that close touch and sympathy between them and the people at home which will tend to a true federation of all parts of the Empire.

In no more important direction is this system destined to do useful work than in the organisation of emigration, not only of labour, but also of capital. The establishment of emigration inquiry offices at provincial centres in connexion with a central department at the Institute, will be of great service to the intending emigrant, by placing within his reach the power of acquiring indispensable information and advice, and by facilitating his attainment of the special knowledge or training calculated to advance his prospects in the new home of his choice. Similarly, the capitalist may be assisted in discovering new channels for enterprise in distant portions of the Empire, the resources of which are awaiting development by the judicious application of capital and by the particular class of emigration which its devotion to public works or manufacturing enterprise in the Colonies would carry with it. The extent to which the State may aid in the organisation of systematic emigration, and the best mode in which it may, without burden to the country, promote the execution of such public works in the Colonies as will open up their dominions to commerce and at the same time encourage the particular class of emigration most advantageous to the Colonies themselves, are subjects of great present interest; but, in whatever way these important questions may be grappled with, such an organisation as the Institute should supply cannot fail to accelerate the establishment of emigration upon a sound and systematic footing, and to co-operate very beneficially in directing private enterprise into the channels best calculated to advance the mutual interests of the capitalists and the colonies.

I have already indicated that it is not only in connexion with purely commercial matters that the Intelligence Department of the Institute will occupy itself. The prospects of its value to the Colonies and to India in promoting the development of their natural resources and the cultivation of new fields for commercial and industrial activity are well illustrated by the valuable work which has been accomplished upon similar lines by the admirably directed organisation at Kew.

By the systematic collection and distribution of information relating to industries and to education from all countries which compete with ourselves in the struggle for supremacy in intellectual and industrial development, the Institute will most importantly contribute to the maintenance of intimate relationship and co-operation between educational, industrial, and commercial centres, between the labourer in science and the sources through which his work becomes instrumental in advancing national prosperity; between the Colonies and the Mother Country, between ourselves and all races included in the vast Empire of Her Majesty.

In conclusion, I venture to express the belief that the organisation which the Imperial Institute will have the power of developing, with a wisely constructed governing body at its head, may accomplish, and at no distant date, other most useful work, which has been already publicly indicated as destined to have an immediate bearing upon the federation of England and her colonies. Prof. Huxley, in his last Presidential Address to the Royal Society, uttered most suggestive words, indicative of the value and the possibility of a *scientific* federation of all English-speaking peoples; and this subject is now receiving the careful consideration of that Society. It is firmly believed by leading men of science that such a federation of at any rate the Colonies and Dependencies with us will be brought about, and it is in harmony with that belief that the Imperial Institute should be expected, through its organisation, to afford important aid in the application of the principle of federation to the geological and topographical survey of the Colonies, in the establishment of a system of interchange of meteorological and scientific observations, and in the promotion, in various ways, of thorough co-operation between particular Colonies, or groups of Colonies, for applying the results of scientific research to the mutual development of their natural resources.

It may be that the programme of which I have given a very imperfect exposition, as indicative of the work which the Imperial Institute may be called upon to accomplish, will be regarded by some as almost too ambitious in its scope for practical fulfilment. The outline of this programme has been drawn by a combination of abler hands than mine; I have but ventured to sketch in some of the details as they have presented themselves to my mind, and to the minds of others who have given thought to this great subject; but I dare to have faith in its realisation, and to believe that, if the work be taken in hand systematically and progressively, the nucleus being first thoroughly established from which fresh lines of departure will successively emanate, the Imperial Institute is destined to become a glory of the land. And, as one whose mission it has been, through many years of arduous work, to assist in a humble way in the application of the resources of some branches of science to the maintenance of the country's power to defend its rights and to hold its own, I may perhaps be pardoned for my presumption in giving expression to the firm belief that, by the secure foundation and careful development of this great undertaking, and by its wise direction, by a government truly representative of its founders—all Nations and Classes composing the Empire—there will be secured in it one of the most important future defences of the Queen's dominions; one of the most powerful instruments for the maintenance of the unity, the strength, and the prosperity of her realms.

THE LOCOMOTOR SYSTEM OF STAR-FISH.

PROF. PREYER, of Jena, has recently concluded an elaborate research "Ueber die Bewegungen der Seesterne." This paper, which contains over thirty illustrations, appears in the Publications of the Zoological Station at Naples (vii.), where the investigation was carried on during a period of nearly five months. This investigation was exclusively physiological, and confined to the star-fish—the Holothurians, Echini, &c., not having fallen within its scope. Considering that Prof. Preyer thus selected a line of experimental inquiry which had been already pretty well worked out, he deserves to be congratulated on the everywhere interesting and frequently novel character of his results. The most important of these results, in so far as they are new, appears to me—as also to himself—to be his demonstration that a severed ray of a star-fish exhibits much more co-ordination in the management of its tube-feet, if the section has been arranged so that two or more of the central ganglia in the disk are left in connexion with the ray, than if only one of these ganglia be so left. It was previously known that under any circumstances the severed ray of a star-fish would not only crawl about, seek the light, &c., but also right itself when turned over on its back. In order to execute this manœuvre highly co-ordinated action on the part of the tube-feet is required, and therefore the interest attaching to Prof. Preyer's observation consists in its having shown that this co-ordination cannot be nearly so well effected by one of the central ganglia as it can be by two or more of them. Or, in his own words, "Also leisten 2 functionell gleichwerthige Theile des Nervensystems zusammen qualitativ mehr als jeder für sich. Man kommt auf die Vermuthung, dass auch bei den höheren Thieren, und vielleicht auch dem Menschen, es nicht allein die qualitative Beschaffenheit der Ganglienzellen, sondern auch ihre Anzahl und Verbindung ist, welche höhere psychische Leistungen ermöglichen."

Highly interesting also are the results of numerous ingenious experiments devised with a view of testing whether the adaptive movements of star-fish can be explained as due to mechanical reflexes alone, or require us to suppose something of the nature

of a rudimentary intelligence. These experiments consisted in placing the animals in various unnatural circumstances, and observing the means which they adopted in order to extricate themselves. For instance, a piece of narrow tube was pushed over one of the rays of a brittle-star, so as to tightly inclose that ray from its base to within an inch or two of its apex. In order to get rid of such an obstruction the star-fish did not always adopt the same method, as we should have expected if the adaptive actions were of a purely reflex kind. Sometimes they rubbed the tube off by friction on the ground; but if the tube were too closely fitting to admit of this mode of removing it, they would adopt sundry other devices—such as holding the tube firmly down by the other rays while drawing the imprisoned ray through its cavity; or by means of the serrated edges of the two adjacent rays progressively pushing the tube upwards over the end of the imprisoned ray; or, lastly, failing every other means, by amputating the imprisoned arm. Various other experiments were tried in the way of pinning down the star-fish in unnatural positions, and the expedients to which they resorted in order to regain their liberty appeared to Prof. Preyer amply to prove the presence in them of psychical as distinguished from merely physiological functions.

Although these are the results of most importance, many others are full of interest to the working physiologist. To me individually this is especially the case, seeing that the research has everywhere proceeded upon the same lines as those which Prof. Ewart and myself adopted while working out the physiological part of our inquiry concerning the locomotor system of Echinodermata. It is satisfactory to note that in almost every particular Prof. Preyer has corroborated our results. There are, however, four or five points—mostly of subordinate importance—with regard to which he expresses disagreement with these results. I have, therefore, carefully considered these points, and have come to the conclusion that the discrepancies admit of being explained, either (1) by our not having worked with the same species of star-fish; (2) where we did work with the same species, by our not having employed precisely the same methods of stimulation; or (3) by the temperature of the water at Naples being higher than that with which we worked in the north of Scotland. This explanation refers to the few, and comparatively unimportant, disagreements upon matters of fact. But Prof. Preyer's principal disagreement with us is upon a matter of inference. He objects to our over-caution in expressly refusing to credit the Echinodermata with any psychical faculties, remarking that many of our own results are sufficient to show that there must be something more than simple reflex mechanism concerned in the adaptive movements of these animals. Here, however, Prof. Preyer has misunderstood our meaning. We did not "expressly declare" that the star-fish are destitute of any psychical faculty: we merely excluded the question from our paper as one very difficult to answer, and as not strictly appertaining to a physiological research. But if Prof. Preyer will turn to a subsequent publication of my own, where this question does require to be considered, he will find that my views upon the subject are in very much closer agreement with his than he at present supposes.[1] Indeed, although I am perhaps less confident in attributing to them any psychical faculties other than that of a short-lived memory (which I argue admits of being proved), I think that the level in the psychological scale to which I do assign them in my book is just about the level to which, in his opinion, they ought to be assigned.

It only remains to add that for my own part I hope Prof. Preyer will next extend his researches to the Echini, which present even more abundant material for physiological investigation than the star-fish, and out of which, therefore, his observant mind may be expected to evolve even more interesting results.

GEORGE J. ROMANES.

THE REPORT OF THE SELECT COMMITTEE ON ENDOWED SCHOOLS.

DURING the present week the Report of the Committee, to the main results of which we were able to refer in our last issue, has been printed. It is a document of first-rate importance. Reserving a more detailed examination of some parts of it for a future occasion, we give this week an extract from the general conclusion of the Report, and also a summary of some of the opinions formed, and recommendations made.

Conclusion.

A pressing need now seems to be that we should not forget, in the search for more immediate advantages of an obvious nature, the importance of preserving, even at some cost, a high ideal of secondary education, both on its own account and in its connexions either with the Universities or with the excellent Colleges which have been recently established in our large towns with the special object of education in relation to the needs of manufacturing and commercial communities. Your Committee find that the work done by the Charity Commissioners under the Endowed Schools Acts, while it has not lost sight of this ideal, has done much to bring higher instruction, in popular and necessary forms, within the reach of classes which otherwise would have been shut out from it. It has thus fulfilled a double function: to promote in all classes the creation of trained intelligence, and to build up a system under which, when created, it may find a free and prosperous scope. With such improvements as your Committee have recommended in future schemes, it is to be hoped that the intelligence of the working-classes will be trained in a direction which, while it develops their intellectual faculties, will at the same time enable these faculties to be more readily applied to the needs of productive industry.

Summary.

The great extension in elementary education under the Education Acts having, to a certain extent, altered the position and objects of elementary endowed schools, in any scheme for remodelling them, special attention should be directed to providing, as far as possible, for the children of the working-classes a practical instruction suitable to their wants in the particular circumstances of each locality.

The policy of the Commissioners has been to establish scholarships in elementary schools and exhibitions from them to schools of secondary education. On the whole these have worked well in large towns, but they are less adapted to the circumstances of a scattered rural population; and in any case scrupulous care should be taken where endowments have been appropriated to the poor, that the paramount interests of the poor should be secured in the application of scholarships or exhibitions provided out of the trust funds.

The abolition of gratuitous education in elementary endowed schools is generally opposed to the wishes of the poorer classes in the localities. It is only justifiable when the imposition of fees gives a higher and more useful character of education to the working-classes than they formerly enjoyed, and after provision made for payment of school fees of children whose parents stand specially in need of such assistance.

The application of non-educational endowments to educational purposes under Section 30 of the Act of 1869 has been beneficial, but the veto now possessed by the trustees of such endowments is, in some cases, a hindrance to reforms and an inadequate protection for the poor. It would be expedient to substitute, for the consent of the trustees, the concurrence of some local representative body.

The diversion of educational endowments from one locality, decreasing in population, to a neighbouring populous locality, is sometimes necessary, but should only take place after the requirements of the locality have been met.

The diversion of an endowment, partially or entirely, from the education of boys to that of girls, has been successful in numerous instances, but when opposed by the localities it requires discretion in its exercise.

The extension of technical and higher commercial education has risen to much importance since the Act of 1869, and should be carefully kept in view by the Commissioners in framing their schemes. When the value of the endowment is too small to provide laboratories and workshops for technical or scientific teaching, the local authorities might be empowered to initiate and aid them by local rates. But before applying local rates in aid of technical or scientific teaching, endowments, the purposes of which have failed, should, as far as practicable, be utilised.

The examination of endowed schools and inspection of the state of the buildings and apparatus, and of the discipline and general working, are subjects of urgent importance. Reports upon the actual condition of the schools should be periodically laid before Parliament. Those reports should be published in the locality in a cheap and convenient form.

[1] "Mental Evolution in Animals," pp. 76, 342, 348–49.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—Applications to occupy the Cambridge table at the Naples Zoological Station should be sent to Prof. Newton on or before May 26.

Mr. S. F. Harmer has been approved by the Senate, on the recommendation of the Special Board of Medicine, as a teacher of Comparative Anatomy for the purposes of medical study.

The reports of Mr. H. Gadow, M.A., of King's College, and Mr. M. C. Potter, M.A., of Peterhouse, to whom grants were made from the Worts Travelling Scholars Fund last year, have just been published.

Mr. Gadow states that he began his researches on July 2, 1886, with the exploration of several caves on the Monte Junto and in the Serra de Athouguia, Province of Estremadura. In the caves were found a considerable number of human and other bones, many of which show unmistakable signs of being worked and cut by prehistoric man; they are now in the Museum of Zoology, awaiting further investigation. Fourteen celts, some worked flakes, and a flint arrowhead, collected in the caves or in the neighbourhood thereof, are now in the Museum of Archæology.

Mr. M. C. Potter joined Dr. Gadow on August 14 at Porto, and immediately went in search of *Clemmys caspica* (the water tortoise which bears the Alga); finding this tortoise was scarce in the North of Portugal, they went to Santarem, where it also was not procurable in sufficient numbers. They therefore proceeded to the Eastern Alemtejo to the mines of São Domingos; here, during several successful expeditions, they succeeded in obtaining a great number of *Clemmys caspica*, and with them a good supply of the parasitical Alga. At the mines of São Domingos, Mr. Potter was able to carry on his investigations through the kindness of his friend Mr. T. Warden, who placed his house at his disposal. The results have already been published in a preliminary form in the Proceedings of the Cambridge Philosophical Society, and will probably be published in full by the Linnean Society of London. To this Alga, hitherto undescribed, he has given the name of *Epiclemmidia lusitanica*, thus describing its nature and to some extent its geographical distribution. The expedition was of great value in enabling him to study the geographical distribution of many plants, and to collect specimens for the Botanical Museum, especially at Coimbra, where the Scientific Staff of the University presented both gentlemen with many valuable specimens.

SCIENTIFIC SERIALS.

Botanische Jahrbücher (A. Engler), vol. viii. Part 3.—On the history of development of form in the Roburoid Oaks, by Franz Krasan (two plates). The author points out, among other conclusions drawn from a comparison of ancient and modern forms, that the developmental series of forms of Oak extending continuously over immeasurable periods of time is compendiously summarised before our eyes in the development of the individual, *i.e.* that the ontogeny is an epitome of the phylogeny.—On *Eria chonéana*, a new species, by Fr. Kränzlin.—Descriptions of Lehmann's collections in Guatemala, Costa Rica, and Columbia: Cyperaceæ, by O. Böckeler; Liliaceæ, Hæmodoraceæ, Amaryllidaceæ, Dioscoreaceæ, and Iridaceæ, by J. G. Baker; Passifloraceæ and Aristolochiaceæ, by Maxwell T. Masters; Lythraceæ, by E. Kœtner.—The Hungarian species of *Inula*, especially those of the *Enula* group, by Vincentius de Borbás.—The remainder of this number is taken up by the continuation of Dr. Winter's excellent epitome of the recent literature on the classification and geographical distribution of fungi, and by Dr. F. von Herders' article on new contributions to the geographical botany of Russia.—Notice is also given in this number of the joint work by Profs. Engler and Prantl, to be entitled "Die natürlichen Pflanzenfamilien." This will be a very comprehensive, profusely-illustrated work, while the names under which it is to be issued will be sufficient guarantee of its excellence.

THE principal article in the current number (vol. v. Part ii.) of the *Folk-Lore Journal* is the continuation of Miss Courtney's paper on Cornish folk-lore, which is very exhaustive. Mr. Kirby calls attention to five tales in the "Arabian Nights," which, though differing greatly from each other, are all based upon two simple fundamental ideas, viz. a door which it is forbidden to open, and the hero falling in love with a woman seen from a house-top. The five tales which are examined lead by curious gradations from the simplest form of the story to the most complex. In response to an appeal issued by the local Secretary in Hong Kong to dwellers in the Far East, we get several Chinese and Japanese contributions. The most important of these relates to the folk-lore of aboriginal Formosa, and is written by Mr. G. Taylor, whose papers on Formosa and its aborigines in the *China Review* were noticed several times last year in these columns. From Formosa, as elsewhere in the world, the cry comes that the aborigines are either disappearing, or are becoming sophisticated by their contact with civilised races. "Come quickly, or you will be too late," says Mr. Taylor to inquirers. He is certainly losing no time in making the most of his opportunities as a resident, and it is to be hoped he will continue his researches. Mrs. Mansfield supplies some interesting Chinese superstitions respecting children; and Mr. Hartland writes on the somewhat hackneyed subject of Japanese New Year decorations. The late Mrs. Chaplin Ayrton almost exhausted this subject in a paper read about ten years ago before the Asiatic Society of Japan, and reproduced by her a few years later in a charming book on child-life in Japan. The other papers, dealing with Negro songs in Barbados, and American song-games and wonder-tales, show that this interesting Society is extending the area of its activity so as to include all parts of the globe. Cornwall, Arabia, Formosa, Barbados, the United States, Japan, do not form a bad assortment for a single number of this journal.

SOCIETIES AND ACADEMIES.

LONDON.

Physical Society, April 23.—Prof. W. G. Adams, Vice-President, in the chair.—The following papers were read:—On delicate calorimetrical thermometers, and on expansion of thermometer-bulbs under pressure, by Prof. Pickering. The reading of a delicate mercurial thermometer, when placed in a bath at constant temperature, is found to depend on whether the thermometer was at a higher or lower temperature than the bath, before immersion. Capillarity was suggested as an explanation, but experiment showed that the effect was not always greatest at the narrow parts of the tube, and hence this idea was discarded. By using the same tube with different bulbs attached, the differences varied, and eventually the effect was found to be caused by exposing the inside of the tube to air and moisture; for when bulbs were attached to new tubes, without being so exposed, the differences between the rising and falling readings disappear. Hence, for very delicate thermometers great care should be taken not to expose the bore of the tube, and calibration of a tube before attaching the bulb must not be attempted. Even in the best tubes, after every possible precaution has been taken, the author finds some parts about which the mercury appears to stick, and in delicate observations these parts of the tube are to be avoided. He also finds it necessary to gently tap the top of the tube to relieve any friction, and has devised a clockwork arrangement for performing the operation uniformly. In the second part of the paper the author describes the want of concordance between the thermometers which have been compared with the same standard, and finds it due to the expansion of the bulbs not being in all cases proportional to the difference of pressure between the inside and outside. Thermometers with large thin bulbs show greatest discrepancies, and the remedy is found to be in making the bulbs more rigid. This is done by having a double bulb, making them from a cylindrical tube instead of by blowing, and increasing the thickness of the walls of the bulb. A knife-edge arrangement in the upper part of a thermometer is described, by which the same part of the graduated tube can be used, whatever the temperature (about which small changes are to be observed) may be. The proper amount of the mercury column can be cut off with the greatest nicety by its use. Mr. Whipple remarked that phenomena similar to those described in the paper were constantly coming under his notice, and mentioned the pressure-corrections they were applying to thermometers used *in vacuo*, during some pendulum experiments at present being carried out. He also described the Kew method of determining the pressure-correction in deep-sea thermometers, which are protected by an outer glass jacket filled with alcohol. Mr. Lant Carpenter described the first comparison experiments made at sea with protected and unprotected bulb thermometers. In answer to questions, Prof. Pickering said the range of pressure used was

from 0 to 3 atmospheres, and in his most delicate thermometer, where 200 millimetres correspond to 1° C., the difference between readings taken in horizontal and vertical positions amounts to 30 millimetres.—Note on magnetisation ; on sequences of reversals, by Mr. R. H. M. Bosanquet. Some experiments have recently been made on an iron bar whose magnetic properties under reversals with ascending values of current were first determined some years ago. The magnetic resistances have again been determined, first with ascending values of current, and afterwards with descending values. In all cases the induction was measured by reversing the current. The results generally show a greater magnetic resistance for descending values of current, except for small inductions where the resistance was less, when the experiments were performed in the above order. The paper concludes with a molecular hypothesis to explain the above results.—On a thermo-dynamical relation, by Prof. Ramsay and Dr. S. Young. The paper is an extension of one presented to the Society on February 26, and of which an abstract was read by the Secretary. The numerical results are given, from which the authors deduce the relation $p = bt - a$, for constant volume, and additional reasons are given for believing acetic acid (whose vapour-density at ordinary temperatures is abnormal) to be a mixture of $C_2H_4O_2$ and $C_4H_8O_4$, the former preponderating as the temperature rises. The authors ask the Society for a name to designate lines connecting pressure and temperature at constant volume, and for which they suggested "*isochor*" in their previous paper.

Zoological Society, April 19.—Mr. Osbert Salvin, F.R.S., Vice-President, in the chair.—The Secretary called attention to a set of eleven photographs representing the principal objects of natural history collected by the celebrated traveller Prjevalsky, during his four expeditions into Central Asia, and to an accompanying catalogue of them which had been presented to the Society's library by Dr. A. Strauch, of the Imperial Museum, St. Petersburg.—Mr. T. D. A. Cockerell exhibited and made remarks on some specimens of rare British slugs taken at Isleworth, Middlesex.—The Secretary read some extracts from a letter addressed to him by Mr. A. A. C. Le Souef, giving an account of a successful attempt to keep the duck-billed *Platypus*, or water-mole, alive in captivity in the Zoological Gardens at Melbourne.—Mr. J. Bland Sutton exhibited some specimens of diseased structures taken from mammals that had died in the Society's Gardens, and made comments thereon.—Mr. J. Bland Sutton read a paper on the singular arm-glands met with in various species of the family Lemuridæ.—Mr. F. E. Beddard read a paper on the anatomy of earthworms, being a further contribution to his researches on that subject.—A communication was read from Mr. A. D. Bartlett, Superintendent of the Society's Gardens, containing remarks upon the mode of moulting of the Great Bird of Paradise (*Paradisea apoda*), as observed in a captive specimen.—A communication was read from Mr. J. Douglas Ogilby, of the Australian Museum, Sydney, containing the description of a rare Australian fish (*Girella cyanea*).—A second paper by Mr. Ogilby contained the description of an undescribed fish of the genus *Prionurus*, obtained in Port Jackson, which was proposed to be called *Prionurus maculatus*.

Chemical Society, March 30.—Annual General Meeting.—Dr. Hugo Müller, F.R.S., President, in the chair.—The President delivered an address, some extracts from which we have already printed.—Prof. Odling proposed that the thanks of the meeting be given to the President for his address, and that he be requested to allow it to be printed. This motion was seconded by Dr. Gladstone, and accepted with acclamation by the Fellows present. The President acknowledged the compliment.—Dr. A. K. Miller and Dr. Rideal were appointed scrutators, and a ballot having been taken, the following were declared elected as Officers and Council for the ensuing year:—President: W. Crookes, F.R.S. Vice-Presidents who have filled the office of President: Sir F. A. Abel, C.B., F.R.S.; Warren De La Rue, F.R.S.; E. Frankland, F.R.S.; J. H. Gilbert, F.R.S.; J. H. Gladstone, F.R.S.; A. W. Hofmann, F.R.S.; H. Müller, F.R.S.; W. Odling, F.R.S.; W. H. Perkin, F.R.S.; Sir Lyon Playfair, K.C.B., F.R.S.; Sir H. E. Roscoe, F.R.S.; A. W. Williamson, F.R.S. Vice-Presidents: J. Dewar, F.R.S.; David Howard; H. McLeod, F.R.S.; Ludwig Mond; C. Schorlemmer, F.R.S.; W. A. Tilden, F.R.S. Secretaries: H. E. Armstrong, F.R.S.; J. Millar Thomson. Foreign Secretary: F. R. Japp, F.R.S. Treasurer: W. J. Russell, F.R.S. Ordinary Members of Council: Messrs. T. Carnelley, M. Carteighe, A. H. Church, Frank Clowes, P. F. Frankland, R. J. Friswell, E. Kinch, R. Messel, H. F. Morley, J. A. R. Newlands, W. Ramsay, Thomas Stevenson.

April 7.—Mr. William Crookes, F.R.S., President, in the chair.—The following papers were read:—Researches on the constitution of azo- and diazo-derivatives; II. Diazoamido-compounds (continued), by Mr. R. Meldola, F.R.S., and Mr. F. W. Streatfeild.—Conjugated sulphates and isomorphous mixtures of the copper-magnesium group, by Mr. P. C. Roy.—Suboxide of silver, Ag_4O, by Mr. G. H. Bailey and Mr. G. J. Fowler.—Action of trimethylenebromide on the sodium compounds of ethylic acetoacetate, benzoylacetate, paranitrobenzoylacetate, and acetonedicarboxylate, by Dr. W. H. Perkin, Jun.

Institution of Civil Engineers, April 19.—Mr. Edward Woods, President, in the chair.—Four papers were read on the subject of obtaining water-supply from wells, namely, chalk springs in the London Basin, by Mr. J. W. Grover; borings in the chalk at Bushey, Herts, by Mr. William Fox; on a borehole in Leicestershire, by Mr. T. S. Stooke; and the wells and borings of the Southampton Waterworks, by Mr. William Matthews.

PARIS.

Academy of Sciences, April 25.—M. Janssen, President, in the chair.—Remarks on M. Colladon's note of April 18, by M. Faye. In reply to M. Colladon's statement that his observations had reference to whirlwinds and waterspouts and not to cyclones or tornadoes, the author points out the great analogy that exists between these two orders of phenomena, both being descending vortices with vertical axis originating in the upper atmospheric regions. The essential difference is that the cyclones are much larger, and that their movement takes its rise at a much higher elevation; but both are subject to the same laws, while it is quite impossible to separate waterspouts from tornadoes.—Experiments for determining the coefficient of nutritive and respiratory activity of the muscles at work and in repose, by M. A. Chauveau and M. Kaufmann. Here a solution is attempted of the physiological problem, to determine for a given weight of living muscular tissue and for all the normal and regular physiological conditions of such tissue (1) the quantity of blood flowing through it in a given time for purposes of nutrition; (2) the weight of oxygen absorbed by this tissue, and of the carbonic acid secreted by it in the same time; (3) the weight of the substances which supply the carbon contained in the carbonic acid gas.—On a new species of truffle, by M. Ad. Chatin. It is shown that the truffle produced in Champagne and Burgundy is not the common species known as *Tuber rufum* and *T. æstivum*, but another hitherto undescribed variety here specified and named *Tuber uncinatum*.—Remarks on a thunderbolt of an unusually destructive character, by M. Daniel Colladon. An electric discharge is described which occurred on April 7 at Schoren in the Canton Bern, and which, after striking a large poplar, spread havoc for some hundreds of metres around, comparable to the effects caused by the explosion of a powder magazine. The shock was felt in Langenthal, three-quarters of a mile off, where several windows in a house were smashed.—On acute pneumonia, by M. Jaccoud. The observations here described establish the fact that true pneumonia is due not to the accidental penetration of specific microbes into the system, as is usually supposed, but to the development under favourable conditions of microbic germs permanently present in the system. A chief condition of such development is a sudden chill, which explains the frequent coincidence of lung affections with abrupt changes of temperature.—Note on the method of research for determining the correlation between two orders of facts, by M. de Montessus. The reference is to M. de Parville's recent paper on the correlation between earthquakes and lunar declination. The difficulty of correlating such phenomena is commented upon, which sufficiently accounts for the failure of the numerous attempts hitherto made to establish a distinct relation between the movements of the moon and those of the terrestrial crust. Such a relation would be equivalent to an experimental demonstration of the hypothesis which assumes that the centre of the earth is in a fluid state.—On the earthquake of February 23, 1887, by M. Albert Offret. With the data supplied from the various localities affected, an attempt is here made accurately to determine the moment when the shock reached the different points in the central part of the seismic area. The results are shown in two separate tables for France and Italy.—Expansion

and compressibility of water, and displacement of the maximum of density by pressure, by M. E. H. Amagat. The author has carried his experiments on water as far as 3200 atmospheres, operating between 0° and 50° C. as limits of temperature, with the general result that a sufficient increase of pressure and temperature tends to bring water within the normal condition of other fluids. Towards 3000 atmospheres the last traces disappear of the perturbations of the general laws resulting from the existence of the maximum of density.—Isogonic magnetic curves, by M. C. Decharme. The author endeavours to show by a series of diagrams the double magnetic influence to which the needle is subjected in the vicinity of a magnet.—A study of the alkaline vanadates (continued), by M. A. Ditte. Here are examined the vanadates of lithine, to which is appended a general table of the well-defined crystallized salts yielded by potassa, soda, ammonia, and lithine.—Artificial production of magnetite, by M. Alex. Gorgeu. By the process here described a magnetic oxide is obtained apparently identical with natural magnetite. It is attracted by the magnet, shows a metallic lustre, and affects opaque octahedral forms, sometimes modified by minute facets of the rhomboidal dodecahedron, with hardness from 6 to 6·5, and density 5·21 to 5·25.—Qualitative study of the sulphites in the presence of the hyposulphites and sulphates, by M. A. Villiers. A convenient and rapid process is described for the research of the sulphites in the presence of the hyposulphites, which, like the former, liberate sulphurous acid by the action of the acids.—On the various sulphurous waters of Olette, Eastern Pyrenees, by M. Ed. Willm. A tabulated analysis is given of these waters on the assumption that all the carbonic acid is combined under the form of bicarbonates.—On synthetic acetonitril, by M. Louis Henry. The acetonitril obtained by the process here described is in every respect identical with that yielded by the dehydratation of acetamide.—On some cases of morphinomania in animals, by M. Ludovic Jammes. Several instances are mentioned of cats, and especially monkeys, acquiring a decided taste for the fumes of opium through association with opium-smokers in Camboja and China.

BERLIN.

Meteorological Society, April 5.—Prof. von Bezold, President, in the chair.—Prof. Upton, of Providence (U.S.A.), spoke on meteorological observations during eclipses of the sun. After discussing the phenomena which may theoretically be expected during an eclipse, he gave a full account of his own meteorological observations, already known to the readers of NATURE, which he made during the eclipses of May 6, 1883, on the island of Carolina, and which have already been published in full. He then discussed an explanation of the barometric variations during the period of totality which had been appended to the report of his observations as published in the *Zeitschrift für Meteorologie*, and expressed his dissatisfaction with the same. He is rather inclined to believe that the very evident fall in the atmospheric pressure before the period of totality is due to an outrush of air which is becoming cooled in the moon's shadow, and that the rise of pressure which is observed shortly after the period of totality is due to a compensating inrush of air. In conclusion Prof. Upton pointed out the importance of making meteorological observations in Prussia, especially as regards the variations of barometric pressure, during the total eclipse of August 19, along the line of total eclipse, and more particularly along the boundaries of the area of totality. In the discussion which followed, Prof. Spörer gave a description of the dense clouds of mist which he observed close to the earth during the eclipse of August 18, 1868, in India. Several days previously to the eclipse there had been a heavy fall of rain; the unclouded sun which rose on the 18th heated the surface of the earth and the dark stones, and then, as soon as the totality began, long, dense bands of mist made their appearance, and with the sharp breeze which was blowing gave rise to a very obvious sensation of coolness. Dr. Zenker then pointed out that, inasmuch as in Prussia the period of totality would occur in the very early morning hours, it would be out of place to expect any very marked variations of either temperature or barometric pressure. On the other hand, he considered that the meteorological observations should be directed more especially to an investigation of Bishop's rings, and of the alternating light and dark bands which precede and follow the stage of totality; they are probably interference fringes, and could be most efficiently recorded by means of photography. Prof. von Bezold laid stress on the importance of observations on the twilight which occurs during the eclipse, pointing out that specially favourable conditions for such observations will present themselves in Germany during this year. It is to be hoped that exact observations of the umbra, the penumbra, and the colours which simultaneously make their appearance will throw considerable light on the phenomenon. Prof. von Bezold intends to provide at the time for an adequately numerous participation in carrying out these observations.

STOCKHOLM.

Royal Academy of Sciences, March 9.—Sir Lowthian Bell, Bart., was elected a foreign corresponding member of the Academy.—On the species and varieties of the Coniferæ found in Scandinavia, by Prof. Wittrock. He also exhibited *Violæ Sueciæ exsiccatæ*, prepared by Messrs. L. M. Neuman, L. J. Wahlstedt, and S. Murbeck.—Report of a visit to some lakes and fresh-water basins in Sweden for the purpose of studying the flora, by Dr. N. A. Lundström.—Remarks on the fishes of the Mediterranean and the Sea of Japan, by Prof. F. A. Smitt.—A description of the collection of Japanese fishes in the zoological museum of the University of Upsala, by Herr E. Nyström.—Researches on the volume and composition of the gases resulting from the solution of iron in acids, by Herr H. Bäckström and Herr G. Paykull.—On the effects of hardening on the volume and composition of the gases evolved on the solution of steel in acids, by Herr G. Paykull.—On the number and congruences of the roots of the second order, by Dr. A. Berger.—On the integration of the differential equations for a material point movement, by Dr. G. Kobb.—The Secretary announced the acceptance of the following papers for publication in the Academy's Proceedings:—On the application of a numerical-theoretic formula for the transformation of a definite double integral, by Dr. A. Berger.—Contributions to the theory relating to the undulating movement in a gaseous body, by Prof. A. V. Bäcklund.—On allaktite from the Långban Mines, by Herr A. Sjögren.

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

The Problem of Evil: G. D. Thompson (Longmans).—Die Natürlichen Pflanzenfamilien, Lief. 1 and 2: A. Engler and K. Prantl (Engelmann, Leipzig).—A Popular History of Astronomy during the Nineteenth Century, 2nd edition; A. M. Clerke (Black, Edinburgh).—Bulletin de la Société Impériale des Naturalistes de Moscou, No. 4, 1886, and No. 1, 1887 (Moscou).—Botany Notes, 2 parts, 3rd edition: A. Johnstone (Livingstone).—Organic Materia Medica: R. Bentley (Longmans).

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