THURSDAY, APRIL 3, 1884

THE "CHALLENGER" REPORTS

Report of the Scientific Results of the Voyage of H.M.S. "Challenger" during the Years 1873-76, *under the Command of Capt. George S. Nares, R.N., F.R.S., and Capt. Frank T. Thompson, R.N.* Prepared under the Superintendence of the late Sir C. Wyville Thomson, Knt., F.R.S., and now of John Murray, F.R.S.E., one of the Naturalists of the Expedition. Zoology, vol. viii. (London: Published by Order of Her Majesty's Government, 1883.)

THE eighth volume of the Zoological Series of Reports on the Scientific Results of the Expedition of H.M.S. *Challenger* contains three Reports. That on the Copepoda is the second Report on the Entomostraca, and is by Dr. G. S. Brady. That on the Calcareous Sponges is by Mr. N. Poléjaeff of the University of Odessa; and that on the Cirripedia is by Dr. P. P. C. Hoek. We learn incidentally from a note by the editor, Mr. John Murray, that the Report on the Foraminifera, by H. B. Brady, F.R.S., is now (December 1883) nearly printed, and that it will be issued at once as vol. ix.

Dr. G. S. Brady's Report on the Copepods contains descriptions of 106 species, for 12 of which it has been necessary to establish 11 new genera. These species were taken almost entirely from surface-net gatherings made during the cruise. While in some few of these gatherings no Copepods were found, Mr. Murray feels certain that these forms were rarely if ever absent from the tow-net gatherings when these were examined on board ship. It seems now certain that the sea from the Equator to the Poles supports everywhere a profusion of Entomostracan life, chiefly of the order Copepoda. The appearance of these little crustaceans on the surface would seem to depend on conditions not yet well understood. Night seems to call them up in larger numbers than the day, but sometimes even in the day they will appear in multitudes so vast as to colour the surface of the ocean for distances of many miles. The cold waters of the Arctic and Antarctic seas are even more favourable to the increase of the Copepods than the warmer waters of the tropics, and Dr. Brady notes that while individuals of some one or two species seem in the polar seas to predominate, in the equatorial and sub-tropical area no one species seems to occur in a very preponderating abundance, but there is a far greater variety of genera and species. While the range of the distribution of the Copepods is extremely wide, still some forms, as *Calanus finmarchicus*, seem to be characteristic of the Arctic seas, while others, as *Undina darwinii* and *Euchæta prestandreæ*, occupy a like position in the tropical and warmer temperate seas.

Dr. Brady follows the sevenfold division into areas adopted in his Report on the Ostracoda. The only undoubted deep-sea species found is *Pontostratiotes abyssicola*, a single specimen of which was dredged in a depth of 2200 fathoms. The fish parasites described are remarkably few, and with one exception seem to have occurred on surface-living fish. It would perhaps not be safe to conclude from this that the deep-sea fish are free from such parasites, but is it not possible that if such forms existed they may have been torn off or destroyed in the transit of the host fishes from the abyssal depths? The single species found was described in manuscript by the late Dr. von Willemoës Suhm, whose description and figures are given. It is called *Lernæa abysssicola*, and was found on a specimen of *Ceratias uranoscopus*, Murray, which was taken at Station 89, from a depth of 2400 fathoms. It is a strangely attenuated and wonderfully transparent form. The thread-like cephalic region and body portion together only a little exceed 13 mm. in length. This most important Report is accompanied by fifty-five plates, all drawn by the skilled hand of the author.

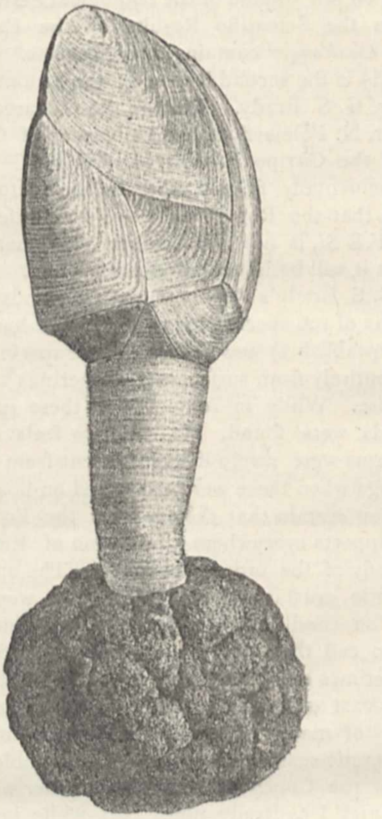
The Report on the Calcareous Sponges, by Mr. A. Poléjaeff of Gratz, a graduate of the University of Odessa, and a trusted pupil of Prof. F. E. Schulze, is a most excellent contribution to our knowledge of this highly interesting group, and entitles its author by its comprehensive criticism and by its attention to practical details, to a high place among modern systematic zoologists. The author had much invaluable assistance in his work, and though living in the somewhat out-of-the-way, though beautifully situated capital of Styria, he had the immense advantage of being able to consult the collection of Oscar Schmidt. It is with pleasure we fully recognise the good use he has made of all these opportunities, and we heartily congratulate him on the result. The Calcareous Sponges of the *Challenger* Expedition were found to belong to thirty species, twenty-three of which are described as new. To describe these was a comparatively easy task, and to arrange them in an orderly sequence was there not the splendid essay of Ernst Haeckel, "Die Kalkschwämme"? True; but there was just the difficulty: for the twelve years that had elapsed since the appearance of this most remarkable work had added so much to our knowledge of the morphology and embryology of this group as to expose the extremely artificial nature of Haeckel's system. Possibly, if the chapter of the history of the Calcareous Sponges had for ever closed on the publication of Haeckel's monograph, the systematic arrangement there adopted, however open to logical attack, might for convenience' sake have stood its ground. But as a *natural* arrangement it would have ever been open to a destructive criticism. Not the least important part of this Report is the free but generous criticism on Haeckel's classification which will command the attention of every one interested in the group of the Sponges. It should also be read by all working on the details of structure of the lower forms of animal life.

It would be impossible in a general notice of this Report to venture into minute details, but while referring those interested in the facts to the first two dozen pages of the introductory remarks, we may observe that the author concludes that "the peculiarities of the canal system of the sponges, the early development of their mesoderm, the circumstance that it is just the mesoderm which in them gives origin to the generative products, and finally the absence of cnidoblasts and nervous elements, taken altogether, though they do not justify the establishment of a new class for the Sponges, are yet important enough to entitle them to occupy an independent position among the Cœlenterata as a sub-class. Within this class the Calcareous Sponges occupy an essentially isolated position, and as a group these may be divided into two orders: (1) Homocœla, and (2) Heterocœla; the former with the single family Asconidæ (Leucosolenia, Bwbk.), the latter with the three families Syconidæ, Leuconidæ, and Teichonidæ. The concluding portion of the introductory chapter we quote as showing that, however destructive may be the author's criticism, he is not unmindful of the merits of the author of "Die Kalkschwämme;" while many of Prof. Haeckel's statements have thus proved to be founded on error, it must never be forgotten that it was his Monograph that called forth and facilitated later investigations, and if we are forced to agree to a certain extent with the judgment of M. Barrois upon this great work, that "l'imagination y a trop souvent pris la place de l'observation scientifique et froide," every one will also agree with another judgment of the very same naturalist, that with the appearance of Prof. Haeckel's Monograph "l'histoire des Éponges entra dans une phase nouvelle." M. Polédjaeff's Report is accompanied by nine plates, in which all the new forms are figured.

The Report on the Cirripedia is by Dr. P. P. C. Hoëk. Taking Darwin's Monograph as a basis of departure, the author gives us (1) a sketch of the development of our knowledge with regard to the number of the genera and species known, their geographical and bathymetrical distribution; (2) a summary of what has been added to our knowledge of the anatomy, embryology, &c., of the group; and (3) a discussion of the different opinions published with regard to the classification of the group, especially since the discovery of the so-called Cirripedia Suctoria or Rhizocephala. The first of these sketches is, from a faunistic point of view, very interesting and instructive, showing both how much and how little is known as to the forms to be met with on our coasts or in our oceans; and, if properly studied, this section may give a very great impetus to the local study of these forms. We read that all "the Cirripedia of the Baltic belong to the genus Balanus;" but, if we are not mistaken, the extremely curious species *Anelasma squalicola* has been found on sharks in this sea, and specimens, we believe, from this locality are to be found in the Berlin and Dublin Museums. To the record given of species of fossil forms described since the date of Darwin's Monograph we may add one that has a peculiar interest being from the pen of the late head of the civilian staff of the *Challenger* Expedition, describing *Loricula macadami* from the Upper Greensand of the County Antrim.

Out of seventy-eight species of Cirripeds represented in the *Challenger* collection only nineteen had been previously recorded, and fifty-nine are named and described now for the first time. In 1854 Darwin gave the number of known Cirripedes as 147, and since then only some eighteen new species have been recorded.

Of the thirty-four genera of Cirripedia at present known the species of twenty-eight have never been observed at a depth greater than 150 fathoms. Two have been found from the shore to 400 fathoms (Alepas and Pœcilasma). Balanus occurs from the shore down to 510 fathoms. Dichelaspis ranges down to 1000 fathoms; and finally only two genera (Scalpellum and Verruca) have been observed at depths greater than 1000 fathoms. The occurrence of these two latter genera in the greater depths of the ocean coincides in a striking manner with their palæontological history, but Dr. Hoëk has not been able to identify any of the recent species with the extinct forms described by Darwin, Bosquet, and Reuss. Of the genus Scalpellum only eleven species were known up to the cruise of the *Challenger;* over forty species were added to the list as the result of the cruise. The majority of the species are inhabitants of deep water; indeed Scalpellum appears to be the only genus of the stalked Cirripedia which is to be often met with at great depths. It is also worthy of note that the observation of Darwin made with regard to the number of specimens of Cirripeds during the Cretaceous period may be made for the recent species of Scalpellum: "The number of species is con-



Scalpellum darwinii.

siderable, the individuals are rare." While the species found during the *Challenger* cruise amounted to forty-three, twenty-six of these are represented by a single specimen only; four are represented by two specimens; five by three; two by four; and only six species are represented by more than four specimens. The study of the complemental males found in some of the species of Scalpellum has given some very interesting results, but we are promised a more detailed treatment of the organisation of these little creatures in a supplementary memoir, which will deal with the anatomy of the group, and which will very shortly be published. In the account of *S. stroemii*, Sars, we find the following:—

"On opening a specimen of this species, dredged in August 1882 by H.M.S. *Triton*, it was found to contain within the mantle cavity a few large embryos; on microscopic examination these were found to have passed already the Nauplius-stage and to have arrived at the Cypris-stage. The exuviæ of the Nauplius-stage still adhered to the covering of the Cypris; still it was not easy to make out which parts had developed from the Nauplius appendages."

The largest species of the genus known has been called *S. darwinii.* Only a single specimen of this splendid form was dredged during the *Challenger's* cruise, and of it, through the courtesy of Mr. Murray, we are enabled to give the woodcut illustration on the previous page. This specimen was found as represented attached to a manganese nodule; these nodules, according to Mr. Murray, are formed by concretionary depositions around shark's teeth, pumice, and other substances at the bottom of the sea; it was dredged at Station 299, December 14, 1875, lat. 33° 31′ S., long. 74° 43′ W., at a depth of 2160 fathoms, from a bottom of gray mud. Four large complemental males were found attached between the mantle and the scutum at a short distance from the apex of the valve and close to its occludent margin. Three specimens were on the left and one on the right side.

Of the genus Verruca, ten species, of which six are new, were found. They are among some of the most interesting forms of animal life collected during the Expedition, and prove that the number of recent species is much greater than had been to this supposed to exist, and that the genus has a true worldwide distribution. Of the six stations which yielded Verruca one belongs to the Northern Atlantic, three to the Southern Atlantic, one to the Pacific, and one to the Malay Archipelago. By these discoveries the range in depth has been immensely increased; the greatest depth known to Darwin for *V. strömia,* O.F.M., was 90 fathoms, but the six new *Challenger* species inhabit depths of from 500 to 1900 fathoms. Of the genus Balanus nine species are referred to, and five described as new; and of the genus Chthamalus one new species is described. This memoir is accompanied by thirteen plates.

The volume has been edited by Mr. Murray, and is one of the most important to the student of invertebrate forms yet published of these Reports.

GERMAN METEOROLOGY

Repertorium der Deutschen Meteorologie. Leistungen der Deutschen in Schriften, Erfindungen und Beobachtungen auf dem Gebiete der Meteorologie und des Erdmagnetismus von den Ältesten zeiten bis zum Schlusse des Jahres 1881. Von G. Hellmann. (Leipzig: verlag von Wilhelm Englemann, 1883.)

IN this goodly octavo volume of 498 pages, presenting an exhaustive catalogue of the meteorological literature of Germany from the earliest to the present time, Dr. Hellmann has done a service to science, the practical value of which it would be difficult to overestimate. The work is divided into three parts. The first part comprises the writings and discoveries, and is in two divisions. The first of these divisions gives the names of authors and the titles of their works; and the fulness and satisfactoriness of detail with which this is gone into may be seen by referring to "Dove," who was the prince of German meteorologists, and "Helmholtz," the latter contributing only one paper—on whirlwinds and thunderstorms—and the former 208 papers, embracing all departments of the subject. The principal events in the biography of each author are briefly indicated, together with the date of publication of each contribution and the work in which it appeared. The second division is an index of subjects comprised under meteorology, terrestrial magnetism, and atmospheric electricity; and the completeness with which this part of the work is done may be seen by a reference to "Barometer," the various papers relating to which are grouped under thirty heads. The heading "Astro-Meteorologie" shows that even the antiquities of the science have not been overlooked.

The second part gives a catalogue of stations, and is in two divisions—the first comprising stations and the different series of observations made at them; and the second, indexes of subjects and observers. The stations are arranged according to the different States of Germany where they are situated; and sections are set apart for stations the observations at which have been published *in extenso;* at which six or more observations have been made daily; stations for investigating forest meteorology, for weather telegraphy, and for international meteorology; high-level stations at heights of 1969 feet and upwards; and stations at which observations have been made for at least fifty years. To these is appended an index of observers' names and their stations.

The third part is historical, presenting an outline of the history of meteorological observations in Germany; a valuable chronological table from the eighth century downwards, detailing the more important facts in the history of meteorology and terrestrial magnetism; and the book closes with interesting statistics showing for the decennial periods beginning with 1480 the progress and extension of meteorological observations over Germany. A map is added showing the meteorological stations in the German Empire at the present time; and on the same sheet a small map showing the stations in Germany in 1781, including those established in connection with the Societas Meteorologica Palatina.

The extreme importance of this undertaking to all workers in meteorology, terrestrial magnetism, and atmospheric electricity, and the ability with which Dr. Hellmann has carried it through, make us regret with a strong feeling of shame the financial difficulty that was allowed to stand in the way of completing a similar catalogue of the meteorological literature of all nations. From Dr. Hellmann's letter to the International Meteorological Committee at Berne, dated July 20, 1880, it appears that all that was required to complete this great work was the raising of a sum not exceeding 1200*l.* As however there appeared to be no hope of this small sum being raised or even guaranteed, Dr. Hellmann, in a spirit and with an energy which cannot but call forth the warmest approbation of scientific men, set to work in the autumn of that year, and was in a position in May 1883 to sign the preface of the work now before us. No small praise is also due to Herr Engelmann, for the effective help he has given in its publication.

For want of such catalogues, the workers, not merely in meteorology, but in every department of science, are crippled, and the remark applies with peculiar emphasis in the case of those who are entering on the work of scientific research. Indeed, the waste of time and brainwork in carrying on scientific work no longer necessary because it has been already done is so great, and the consequent material loss to the nation so serious, that the time cannot be far distant when the Governments of this and other countries will have no choice, but yield to the demands made for a moderate annual grant towards defraying the expenses incurred in preparing and publishing these indispensable aids to all workers in science.

OUR BOOK SHELF

Berly's Electrical Directory. Third Edition. (London and New York, 1884.)

THIS work consists of three separate directories, separately paged, but bound up together; the first, of 228 pages, relates to British trades and professions connected with electricity; the second, of 273 pages, is devoted to similar matters from America; whilst the third is Continental. Of the last, 71 pages are French and Belgian, 12 German, and 3 relate to other countries, chiefly Russia. This arrangement, though convenient probably to the compilers, strikes us as being bad for many purposes. The American and French sections are particularly full of information. The British section opens with remarks on the progress made in electrical business during the past year, after which come various tables and formulæ. These are by no means satisfactory. In the formulæ for dimensions of units, many of the numbers which should have been printed as powers are given as simple multipliers. Though the table begins with C.G.S. units, and professes to describe those accepted by the British Association and the International Congress of 1881, the ohm is given as equal to 10^7 absolute units and the volt as 10^5, whereas the figures should respectively be 10^9 and 10^8. All this is very misleading. So also is the following statement:—"Calling gravitation the natural unit of force, the absolute unit of force will be $\frac{1}{9 \cdot 81}$th part of it." This statement ushers in the following definition:—"*Unit of Mechanical Effect* is the unit of force carried up through one centimetre, or $\frac{1}{9 \cdot 81}$ raised one centimetre." Is it possible that this chapter on formulæ has been translated literally from the pages of some French writer who was in the habit of using a mixed metre-gramme-second system instead of either the centimetre-gramme-second or the metre-kilogramme-second system? With the exception of the scientific part, the editing appears to have been carefully and soundly done, and the commercial information is very extensive.

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.*]

"The Unity of Nature"

IT was, I think, in the course of last year, or of the year preceding, that I ventured to remonstrate against the use sometimes made of your columns by Mr. G. J. Romanes for the purpose of inculcating his personal beliefs, and disbeliefs, on subjects which lie outside the boundaries of physical science.

The observations made by him in your paper of March 20 upon the book I have lately published ("Unity of Nature") show that in that remonstrance I committed an offence which Mr. Romanes has not forgotten or forgiven. Nevertheless I must repeat it; and this time I have the advantage of his own confession, that "the pages of a scientific journal are not suited to an examination" of those parts of my book which he has nevertheless denounced in your pages with unusual violence of language. If your pages are not suited to such an examination, neither can they be suited to comments which nothing but that examination could justify. The tone of these comments is a very clear proof of the necessity of our all keeping within the marches when we meet on neutral ground. Scientific facts and scientific hypotheses constitute that neutral ground. On the other hand, the bearing of these facts and of these hypotheses on questions of philosophy and of religion constitutes a separate region in which, if we meet at all, it must be outside the pages of a purely scientific journal. In that separate region it has always been my endeavour to argue without personal passion and without contumely towards opponents. I should be ashamed in any argument to display the animus which has in this case dictated the language of Mr. Romanes on subjects which, by his own confession, he has no right to drag into your pages. He may hold that the highest aim of the human intellect is to prove the mindlessness of nature. My book deals, and was intended to deal, with this philosophy; and I did not expect Mr. Romanes to like it. How much he dislikes it is remarkable. But he will find no passage in it which descends to the level of some of his comments.

Having dismissed, as irrelevant in your columns, the criticisms of Mr. Romanes on the "Unity of Nature" which have no connection with science, I now turn to some of those which have this connection, and are at least perfectly legitimate in their character.

Mr. Romanes is quite right when he says that I object to the "*newer philosophy*" which makes experience the source of instinct. In my view this theory is, in the strictest meaning of the word, nonsense, because experience is obviously a "synthesis of intuitions," and not the source of them. It is a plain fact that instinctive movements and instinctive sensations are the conditions precedent—the sole materials—of experience. Experience is nothing but the memory in living creatures of their own previous action on external things, and of the reaction of external things upon themselves. It is the combined consciousness of both which builds up what we call experience. But in every step of this process, whether of action, or of reaction, or of the combined memory of each, not one instinct only, but several instincts are concerned. Experience therefore is the result of instinct, and not the converse.

With this argument Mr. Romanes does not even attempt to deal.

He does, however, attempt to deal with my contention that instinct is always strictly correlated with organic structure, and that special instincts are always connected with "organs already fitted for and appropriate to the purpose." He says that my own case of the dipper ought to have taught me better; "for," he adds, "the dipper belongs to a non-aquatic family of birds, and *therefore* has no organs specially adapted to its aquatic instincts."

This argument, as an argument, is a *non sequitur;* and as a statement of fact is altogether erroneous. It is quite true that the dipper has not webbed feet. But it is not true that webbed feet are at all necessary for aquatic habits of a particular kind; nor is it true that the dipper is wanting in other peculiarities of structure which are most specially adapted to its peculiar aquatic habits and instincts. There are many birds which swim excellently well without webbed feet, as, for example, all the Gallinules, and some of the Tringidæ. The dipper does not need webbed feet, because it neither swims nor dives in deep water; and because on the other hand it positively needs feet free from web for grasping stones under rapid streams, as well as for grasping rock-surfaces in the places of its nidification. On the other hand, the structure of its wings, and above all the structure and texture of its feathers, are all specially modified and adapted to its aquatic habits.

It is for Mr. Romanes to prove, if he can, that the dipper once had an ancestor which began to dive in water, whilst as yet its wings had not a shape and a texture adapted to the purpose, and whilst its plumage was still pervious to water, and so was liable to be drenched and sodden.

Mr. Romanes protests against my suggestion that rudimentary organs may, sometimes at least, be the beginnings of a structure destined for future use, and not the relics of a structure whose use has been in the past. Yet in the same paper he himself suggests that the dipper may be on the way to having webbed feet, and only wants them now because it has "not yet had time to develop" them. But when these webs do begin to appear, they would naturally be small, and would appear to be rudimentary; so that in this stage they would exactly represent the "wholly untenable doctrine" which Mr. Romanes denounces as an "inversion of Mr. Darwin's teaching." As a matter of fact rudimentary organs on the way to future use can be identified in the aquatic larvæ of the Ephemeræ.

The truth evidently is that the theory of the origin of species by transmutation, involves of necessity a constant succession of structures which are on the wane, and another succession of structures which are on the stocks. Whether any particular structure now dissociated from use, belongs to the one or to the other class, is a question of evidence from associated facts. But the idea of some structures being on the rise, is an idea inseparable from the theory of evolution as taught by Darwin. Fully persuaded, as I am, that there is a very large amount of truth in that theory, I am equally persuaded that, as yet understood, it is incompetent to solve the most important phenomena of creation. In the hands of Mr. Romanes, and of many others, it is almost reduced to the repetition of mere verbal formulæ, under which anything and everything may be brought, only because they are empty of any definite meaning. The derivation of instinct from experience is an excellent example.

ARGYLL

Rain-band Spectroscopy Attacked Again

I HAVE just had the honour of receiving a copy of an essay read before the Philosophical Society, Washington, D.C., and printed in the *American Journal of Science* for the present month, wherein I read on p. 209:—

"The results of observations with the rain-band spectroscope are now called in question by many prominent meteorologists. In fact the unsatisfactory nature of the evidence may be easily shown to the satisfaction of any one possessing an instrument. If the spectroscope is first turned to the sky in any direction and afterward to a white wall fifty feet distant, it will be found impossible to distinguish between the appearance of the rain-band as shown by the whole atmosphere and by the layer fifty feet thick."

If this be the most damaging accusation that can be brought up, after the memorable correspondence in both NATURE and the *Times* during the autumn of 1882, there is hope of converting "the prominent meteorologists" yet.

For cannot they, as well as other men, see, that a white wall close to an observer in daylight, necessarily reflects the light, and with that, the spectrum, of the sky which is illumining it, solar lines and telluric lines and all!

Or if the worthy gentlemen still doubt, let them illumine their white wall at midnight with policemen's lanterns or Swan's incandescent lamps; and then I can promise them they will get out of it and the "layer of air fifty feet thick" in front of it, neither solar nor telluric spectrum lines in any kind of weather.

C. PIAZZI SMYTH

15, Royal Terrace, Edinburgh, March 25

The Remarkable Sunsets

IN reply to inquiries sent out by me to Prof. John Milne of the University of Tokio, Japan, I am informed that no volcanic dust was known to have fallen in Japan during or after the Krakatoa eruption. He forwards, however, the following extracts, which may be of interest to your readers.

JOHN W. JUDD

Science Schools, South Kensington, S.W.

"*Japan Gazette, Friday, Sept.* 21, 1883.—Shortly after noon on August 30 the sun seemed to diminish in power, and a uniform yellow gray haze spread over the sky, gradually becoming more pronounced, and at two hours before sunset its rays were merged into a faint halo emerging from a globe of light no larger than the full moon. On Friday, August 31, at 8 a.m., sun the same. At 11 a.m. looked like full moon; could easily observe it with the naked eye. At intervals, faint clouds like puffs of smoke crossed the sun's face; they were enormously high. No wind; atmosphere dull and heavy, and neither heat nor light. September 1, the same. On Sunday, sun became as usual, and haze passed away. The Japanese were alarmed, and expected earthquakes."

Prof. Milne adds the note: "If this were due to Krakatoa, almost 2500 miles away, the speed of the dust must have been thirty miles an hour, assuming the date of the eruption to be 12 p.m. on August 26."

THE coloration of the sky in the neighbourhood of the sun, described by "B. W. S." in NATURE of March 27 (p. 503), has been repeatedly observed by myself from February 20 (or thereabouts) up to March 24. My first record of it is on February 24, when I describe it as a "rusty-red" tint. On other occasions I have called it "rusty brown" and "pale brick-red." Sometimes it has had a purplish or roseate hue. It has been chiefly seen between 10° and 20° from the sun (at a rough estimate), and only when the sun was hidden by a detached cloud. Frequently, when the sky has been clear, the intervention of a house or other object between the observer and the sun has revealed the presence of a hazy metallic-looking glare around the sun—an appearance not perhaps very remarkable in itself, but remarkable by its frequent repetition.

If, as seems probable, the explanation of these phenomena is to be found in a gradual subsidence of the reflecting matter which occasioned the remarkable sunsets, it will be well for observers to be prepared with suitable arrangements for catching what may fall. I have myself had in operation for some time past two separate devices for this purpose, the one intended for dry weather, the other for rain. In dry weather I expose a tray containing a number of glass slides, each with a drop of glycerine in a shallow cell, ready to be covered with thin glass after sufficient exposure. For rain I use a 12-inch bell-glass supported in an inverted position on a three-legged stand, the legs partly buried in the earth, and the height such as to raise the receiving area of the glass to 30 inches above the soil. A rain-gauge is less suitable for the purpose, and experience has shown me the necessity of guarding against the introduction of particles of soil by the rebound of hailstones.

An investigation of this kind is difficult in the neighbourhood of a city, and it is much to be wished that observers living in isolated situations may be induced to undertake it.

It may be worth recording that on February 24, after an interval of several weeks, we had a striking recurrence of the sunset phenomena so often described. It was not perhaps the very finest example, but, as regards the primary glow, there had been nothing equal to it since January 12. Unfortunately I was not able to watch for the secondary glow. It is singular that at both the beginning and end of this series of phenomena there should have been outlying examples separated by some weeks from the rest. The first of the peculiar sunsets observed in this country appears to have been on November 9. Then I find no record until November 24. From that date (allowing for interruption by weather) they may perhaps be considered to have been continuous until February 2, becoming scarcely noticeable towards the last. Then, finally, after an entire absence of fully three weeks there comes, on February 24, a sunset which must be ranked amongst the finest of the series.

Clifton, March 31 GEORGE F. BURDER

REFERRING to the "decidedly unusual *pink tinge*" occasionally observed around the sun "when shining in a somewhat hazy sky, the colour being brought out with great distinctness if a light cloud happens to be passing across it" (see NATURE, March 27, p. 503), I would mention that, under the described circumstances, I have often noticed last winter a peculiar colour, to which I would apply the French term *velure d'oignon* (onion skin), used to describe certain kinds of champagne. I offer this suggestion, as I know the value of precise and happily chosen terms, especially in the difficult matter of the terminology of colours.

O. S.

Heidelberg, Germany, March 29

Thread-twisting

THE habit of thread-twisting with the palm of the hand on the thigh is one which may be seen in every part of India at the present day; we think it can hardly be termed a rude method, or a savage art, though the Mohammedans, whose ancestors came not so very long ago from Central Asia, practise it as much as, or even more than, the Hindoos. As "J. S." observes in NATURE of March 20 (p. 478), it may be one of the survivals from a barbarous period which we have lost since the introduction of machinery. Perhaps some of your correspondents may be able to tell us whether it is in use in the Orkneys and the Hebrides, or elsewhere, where the people still spin their own wool.

COSMOPOLITAN

MEASURING HEIGHTS [1]

THE system of barometric hypsometry described in this treatise—first communicated in 1877 to the Philosophical Society of Washington—was suggested by the needs of the geographical surveys conducted by the Government of the United States in the mountainous region lying between the Great Plains and the Pacific Ocean. The system proposes a new method of observation and computation. It is not of universal application, but the range of work to which it is adapted is large and deserving the attention of the geographer.

The *method of observation* is as follows:—Two base stations are established—one high, the other low. Their difference in altitude is made as great, and their horizontal distance as small, as practicable. Each station is furnished with a barometer only, and observations are made at frequent intervals through each day. At each new station a barometer is observed, and no other instrument. The difference in altitude of the two base stations is determined by spirit level, and forms a vertical base by which all other intermediate altitudes are *computed as follows*:—The readings, being corrected for index error and temperature of instrument, are collected in groups of three, each observation at a new station being accompanied with the simultaneous observations at the two base stations. The resulting difference of heights of the lower and the new station is then computed by the following formula, in which if L, U, N represent the height of the lower, upper, and new stations respectively, and l, u, n the simultaneous corrected barometric readings at the same stations, and also let $B = U - L$, $A = N - L$, and $B - A = U - N$; then it is found approximately that—

$$A = B \frac{\log l - \log n}{\log l - \log u} + \frac{A(B - A)}{D}.$$

where $D = 490{,}000$, if A and B are reckoned in *feet*; or 149,349 if in *metres*. This formula consists of two terms—the first, or *logarithmic term*, is the principal one; the second, or *thermic term* (so called), is always very small in comparison with the first—so that it suffices to substitute for A in the second term the value of the first. The following example of computation further illustrates the formula:—

In August 1872 the simultaneous mean pressures at Sacramento, Colfax, and at Summit were 29·879, 27·475, and 23·336 inches respectively, and the altitude of Summit above Sacramento is 6989 feet. Required the altitude of Colfax above Sacramento. In this case:—

$l = 29{\cdot}879$ $\quad \log l = 1{\cdot}47537$
$n = 27{\cdot}475$ $\quad \log n = 1{\cdot}43894$
$u = 23{\cdot}336$ $\quad \log u = 1{\cdot}36803$
$\log l - \log n = 0{\cdot}03643$
$\log l - \log u = 0{\cdot}10734$

log (0·03643) = – 2·56146
log (0·10734) = – 1·03076

Difference = – 1·53076
log B = 3·84441 6989 = B

sum = log (first term) = 3·37511...2372·0 = first term = A nearly
log (B – A) = 3·6644 ...4617 = (B – A) (approximately)
colog (490000) = – 6·3098 ...

Sum = 1·3493 = log 22·4...the second term

Required difference of altitude = 2394·4 feet.

The author, considering the direct calculation of the second term inconvenient, has calculated a table of double-entry showing the value of this term as a correction of the first term for every 100 feet of B and of the approximate value of A, which is appended. A graphic table is also appended (plate lxii.) for computation of this *thermic* correction. However, as the table of logarithms must be to hand, the direct calculation does not seem to present any particular inconvenience.

By thus abandoning the thermometer and psychrometer, and employing the barometer alone, the author reverts to elementary principles upon which all barometric measurements depend, and presents in his first chapter a review of the purposes and conditions of barometric hypsometry in general, and although not presenting anything new, is yet very interesting. The principle which underlies the measurement of heights by the barometer is exceedingly simple, but its application is fraught with difficulty. The law of the relation of altitude to atmospheric pressure is consequent on the law of the compressibility of gases, and is simply a certain multiple of the logarithm of the air-pressure. But there are numerous modifying conditions which must be considered in the application of this law. After describing the construction of barometers, of which the mercurial is both the oldest and the most accurate, the author passes to the consideration of the modifying conditions of the temperature and humidity of the atmosphere which are ever varying, so that the static order of densities is broken, currents are set in motion, and the circulation and the inequalities of temperature conspire to produce inequalities of moisture. Every element of equilibrium is thus set aside, and the air is rendered heterogeneous in composition, temperature, and density. Moreover, the disturbing factors are so multifarious and complex that there is infinite variety of combination and infinite variety of result. Approximate solutions of the problem are therefore only expected; and the author, after describing the disturbing factors—gradients, temperature, humidity—and the various devices for the elimination of the errors due thereto, and other general devices for diminishing hypsometric errors and the relative importance of different sources of error, arrives at the conclusion that the difficulties which inhere in the use of the barometer for the measurement of heights are so numerous and so baffling that there is no reason to hope they will ever be fully overcome. The best that can be done is to mitigate them, keeping in mind that the barometric method must not be so elaborate that its cost will approach that of the use of the spirit level. The problem, therefore, which occupies the attention of those who have occasion to use the barometer in extended surveys is how to secure the best result from a single observation at a new station combined with a series of observations at one or more base stations.

The author next proceeds in the second chapter to develop his *new method*, as explained above, and determines a mean value of the *thermic constant*, D. In Chapter III., on "Comparative Tests," various tables are given of the comparative results obtained by means of the new method and the ordinary and other empirical methods in use. This comparison shows the advantage of the new method in a reduction of one-half the error of the ordinary method, and one-fourth that of the empiric method. Nevertheless there is a considerable range of special cases in which the ordinary method can never be superseded.

Having shown that the new method is theoretically plausible and practically successful, the author considers in the fourth chapter the nature of possible improvements. This chapter, and the following fifth chapter on the limits of utility, and the sixth on the work of others, are more specially addressed to the students of hypsometry. This interesting work closes with a short chapter, the seventh,

[1] "A New Method of Measuring Heights by Means of the Barometer." By G. K. Gilbert. Extract from the Annual Report of the Director of the U.S. Geological Survey, 1880-81. (Washington: Government Printing Office, 1882.)

on the use of the table of the values of the *thermic term* —before-mentioned—and a supplementary note on devices to eliminate the influence of wind-pressure.

It may be stated that of the seven plates referred to as illustrating this work, six are wanting in the copy now under notice.

ON A METHOD OF ESTIMATING THE STEADINESS OF ELONGATED SHOT WHEN FIRED FROM LARGE GUNS

IN October last it was stated in the newspapers that "at the request of Lord Alcester," and in the presence of the Lords of the Admiralty, "comparative trials of a Krupp gun and a 6-inch breechloader took place *greatly to the advantage of the former*." . . . "The projectile used in the English weapon was 100 lb. with a 34 lb. charge, and that in the Krupp gun 64 lb. with a 14 lb. charge, *the results from the latter being far in advance of the former*." If this statement be exact, the matter calls for the most careful consideration. In such a case the superiority of the Krupp gun must have arisen either from the higher initial velocity, or from the greater steadiness imparted to the shot by the Krupp gun, or probably from both these causes combined. The comparative merits of these or any other guns could be very readily settled by well-known methods of experimenting, at the expense of little more than the cost of 5 to 10 rounds of ammunition for each gun. There is no necessity for a repetition of the Armstrong and Whitworth competition, said to have cost some 30,000*l*.

Numerous experiments were made in this country in 1867-68 with guns of 3, 5, 7, and 9 inches calibre, to determine the resistance of the air to the motion of both round and elongated projectiles. Coefficients of resistance were then determined for all velocities between 900 f.s. and 1700 f.s. Additional experiments were made in 1878-79 with elongated projectiles alone, which gave the coefficient of resistance K corresponding to all velocities between 430 f.s. and 2250 f.s. But after this report had been printed, which contained general tables for both *time* and *space* within the above-named limits of velocity, it was decided to have additional experiments made with both lower and higher velocities. The final report of these experiments was published in 1880, which contained general tables for *space* and *time* for velocities between 100 f.s. and 2900 f.s. The values of K_v corresponding to the velocity v, as given in this report, will be hereafter referred to as the "tabular" values of K_v. The weight of a cubic foot of air was taken to be 534·22 grains.

In testing any new gun I would proceed, as in the above-named experiments, to measure the times occupied by the shot in passing over a succession of equal distances. These observations would readily give the velocity v of the shot at any point of its path, and also the corresponding coefficient of resistance K_v. Then according as the mean value of K_v derived from 5 to 10 rounds, was found to be *greater* or *less* than the tabular value of K_v, it would be evident that the gun on its trial gave a *less* or *greater* degree of steadiness than the average of the guns used in the experiments of 1867, &c.

Let us examine the relative value of these four guns in rounds where the middle velocity was about 1280 f.s.

Rounds 6-12, 124 and 126 were fired from the 3-inch gun, with projectiles of 9 lb., giving for K_{1280} respectively the values 136·5, 110·7, —, 114·5, 118·2, 121·0, 119·2, 111·7, and 111·2; the mean of which, 117·9, is 8·9 *higher* than 109·0, the tabular value of K_{1280}. Consequently this gun falls *below* the average in steadiness very decidedly.

Rounds 164-168 were fired from a 5-inch gun with projectiles of 47·68 lb., giving for K_{1280} respectively the values 110·?, 98·9, 91·0, 101·5, and 97·9; the mean of which, 99·9, is therefore 9·1 *below* 109·0, the tabular value of K_{1280}. Consequently these solid 5-inch shot had a very *high* degree of steadiness.

Rounds 148-153 were fired from the same 5-inch gun, but with hollow projectiles of 23·84 lb., giving for K_{1280} respectively the values 105·1, 113·4, 101·5, 105·4, 107·7, and 102·0; the mean of which, 105·9, is 3·1 *below* 109·0, the tabular value of K_{1280}. The steadiness of these shot was *above* the average, but inferior to that of the solid 5-inch shot.

Rounds 97-101 were fired from a 7-inch gun, with projectiles of 123·125 lb., giving for K_{1300} respectively the values 109·8, 118·7, 108·6, 117·6, and 117·5; the mean of which, 114·4, is 5·8 *greater* than 108·6, the tabular value of K_{1300}. The 7-inch projectiles were therefore *deficient* in steadiness.

Rounds 218-221 and 228 were fired from a 9-inch gun with projectiles of 250 lb. giving for K_{1280} respectively the values 110·4, 104·8, 126·0, 118·9, and 131·2; the mean of which, 118·2, is 9·2 *above* the tabulated value 109·0 of K_{1280}. The 9-inch shot were therefore very *unsteady*.

We thus arrive at the character of each of the experimental guns from the error in K_v. In the 3-inch gun the error was + 8·9; in the 5-inch gun (solid shot), − 9·1; in the 5-inch gun (hollow shot), − 3·1; in the 7-inch gun, + 5·8; and in the 9-inch gun, + 9·2.

Some experiments were made with projectiles provided with various forms of heads in 1866. Although the programme was never fully carried out, the rounds fired with hollow ogival-headed shot of one and two diameters were tolerably numerous. The two forms of shot were fired alternately, and gave the following values of K_{1400}.

Round	One diameter	Error	Round	Two diameters	Error
14	108·6	+0·1	15	108·0	+4·6
16	113·1	+4·6	17	—	—
18	109·6	+1·1	19	—	—
20	108·0	−0·5	21	103·5	+0·1
22	105·3	−3·2	23	104·6	+1·2
24	110·1	+1·6	25	99·1	−4·3
26	108·1	−0·4	27	100·8	−2·6
28	108·4	−0·1	29	103·0	−0·4
30	109·6	+1·1	31	104·0	+0·6
32	104·4	−4·1	33	104·2	+0·8
	10)1085·2	16·8		8)827·2	8)14·6
Means ...	108·5	1·7	Means ...	103·4	1·8

The tabular value of K_{1400} is 104·7, which was derived from experiments made with ogival-headed shot struck with a radius of one diameter and a half. The unit of K in the above cases corresponds to about the 1/50,000 of a second.

M. Krupp has recently circulated some tables which are based on coefficients, a little less than the tabular numbers above referred to, and about such as would have been obtained if I had used those coefficients only which were given by the most steady moving projectiles. Since 1868 there have been great improvements made in the manufacture of slow-burning powder, &c., which may have tended to give increased steadiness to the shot, and thus to reduce the resistance of the air slightly. Still I do not think it desirable at present to reduce my coefficients sensibly, because in all my experiments the velocities have been determined during the motion of the shot just after it had left the gun. But when the range of the shot is considerable, the direction of the axis of the shot must become inclined to the direction of the motion of the shot, and this must increase the resistance of the air. If it was thought desirable to reduce the coefficients of resistance throughout any range in a particular case by $\frac{1}{20}$th or $\frac{1}{10}$th, &c., this could easily be effected by multiplying $d^2 \div \omega$ by $(1 - \frac{1}{20})$, $(1 - \frac{1}{10})$, &c. For heavy shot the range should be extended much beyond 500 yards.

The pamphlet alluded to above is entitled "Table de Krupp pour le calcul des vitesses restantes horizontales et des durées de trajet des projectiles oblongs. Essen, 1881." M. Krupp does not give any details of the experiments on which he professes to have founded his tables, or acknowledge any kind of assistance from any other author. He remarks that for a long time the resistance of the air was supposed to vary as v^2, then to depend upon two powers of v, and afterwards to vary as v^3 or v^4. Experiments have shown that these so-called laws of resistance are not good for all velocities. "Cette expérience devait le faire paraître utile de trouver une nouvelle méthod pour le calcul des vitesses restantes" (p. 16). And again, "Un tel tableau pour différences de vitesse de 10 cm. a été établi par l'usine Krupp au commencement de l'année 1880" (p. 18).

M. Krupp's tables are precisely the same as those that have been used in England since 1871, except only that French replace English measures, and that a small reduction of the English coefficients of resistance has been made throughout. Taking one of Krupp's examples (last page) 11/6/79, where d = 355 mm. = 13·977 inches; w = 525 kilos. = 1157·43 lbs.; commencing velocity 490 m.s. = 1607·64 f.s.; remaining velocity 415 m.s. = 1361·57 f.s., at distance 2384 m. = 7821·6 ft.; weight of 1 cubic metre of air = 1·200 kilos., M. Krupp finds from his table 411·8 m.s. for the remaining velocity instead of 415 m.s. given by his experiment. My table gives a remaining velocity of 405·7 m.s. But supposing we reduce the coefficients of resistance in the proportion 99·9 : 109·0 given by the experiments made with the 5-inch gun (solid shot), then we obtain 412·0 m.s. for the required remaining velocity, which is nearly the same as 411·8 m.s. obtained by the use of Krupp's table. Again, taking the experiment 6/8/79 with a projectile 400 mm. in diameter, commencing with a velocity 533·4 m.s., M. Krupp finds a remaining velocity of 447·0 m.s. by the use of his table, while I obtain 440·4 m.s. and 443·8 m.s. is given as the result of experiment. But if I reduce all my coefficients as before in the ratio 99·9 : 109·0, then my table gives 447·4 m.s. as the remaining velocity, which agrees with M. Krupp's calculations. Hence it appears that M. Krupp claims by these tables that his guns of 1880, on the average, give a degree of steadiness about equal to that given by the best of the four English experimental guns used in 1867-68. I have not much confidence in the accuracy of velocities measured at a distance of near one mile and a half from the gun by an instrument not specified, but I have used these data as a means of indicating to what extent the tables give different results. As a test of the tables I should much prefer a careful determination of the commencing velocity of the shot, and the time of flight to some known distant point, where all the times were measured by a *single* instrument.

For further information I beg leave to refer M. Krupp to (1) "Tables of Remaining Velocity, Time of Flight and Energy of various Projectiles, &c.," 1871; (2) to the *Proceedings of the Royal Artillery Institution*, Woolwich, September 1871, p. 382, &c.; (3) *Ib.*, April 1872, p. 1, &c.; (4) *Ib.*, December 1877, p. 250, &c.; (5) "Treatise on the Motion of Projectiles, &c.," 1873; (6) "Principles of Gunnery," by Major Sladen, R.A., 1879; (7) "Handbook for Field Service" (R.A.), 1878; (8) "The Construction of Ordnance, &c.," p. 359, &c., 1877; (9) "Reports on Experiments, &c., 84/B/2853," 1879; (10) "Final Report on Experiments, &c., 84/B/2909," 1880; and (11) and (12) "Manual of Gunnery for H.M. Fleet," 1880. And since that date my "General Tables" have been reprinted in four different books.

Since the above was written, I have noticed that the introducer of the Navy Estimates, 1884, remarked:—"*The old breech-loader* had been found to be of no more use than a muzzle-loader, and the Government had adopted a *gun twice as long* as the *old* form of breech-loader." I always understood that the profitable use of the new slow-burning powder required a *long* barrel, and that the breech-loading arrangement was introduced because it permitted the use of a longer barrel on shipboard than could be employed with muzzle-loading.

March 22 FRANCIS BASHFORTH

THIRD NOTE ON THE ELECTRICAL RESISTANCE OF THE HUMAN BODY

IN two previous communications last year, I showed that the amount of this important basis of rational electrotherapeutics had been enormously overstated. Since then I find it given in the new edition of Rosenthal's "Elektricitätslehre," published in the current year, as about 5000 ohms, and, to my surprise, so competent an observer as my friend Prof. Dolbear, in Lockwood's "Handbook of Electric Telegraphy," states it vaguely as from 6000 to 10,000 ohms. On the other hand, Count Du Moncel, in his paper on the conductivity of imperfect conductors in the *Annales de Chémie et de Physique*, vol. x., 1877, approaches more nearly to the real value in stating it from wrist to wrist to vary from 350 to 220 kilometres. This is probably the Swiss unit given in Clark and Sabine's tables as equal to 10·42 ohms or thereabouts. Both Rosenthal and Du Moncel furnish internal evidence that their excessive estimates were due to imperfect contact through the skin: for the former speaks of using fifty chromic acid elements of two volts E.M.F. each; whereas the current from this large battery, with proper contact, would be utterly unbearable to the patient, if not dangerous. The highest current I have seen employed was from twenty-two of these cells through less than 2000 ohms resistance. It was done against my advice, and produced a large carbuncular boil at the nape of the neck, where the negative pole was applied. I have since then completely modified my method of making the skin contacts, and no similar accident has occurred.

Even with a far smaller current, namely, that of eight Daniell cells and small platinum electrodes, of which the size is accurately given, namely, 4½ by 3 cm. (roughly, the length of two shillings side by side, and the breadth of a florin), Du Moncel produced a similar though much more serious accident. The current was passed at intervals for an hour and a half from wrist to wrist, the patient being a lady, and afterwards for shorter periods in the opposite direction. "On withdrawing the electrodes," says the writer, "to my great astonishment I found, on the parts of the wrists where my electrodes had been applied, very pronounced scars resembling burns produced by an acid or a caustic. These scars, to the number of three at the negative pole, were large and deep. At the positive pole they were very small, and thirty-two in number. During the first two days after the experiment no inflammation supervened, but on the third day it began about the negative scars, and it was necessary to have recourse to poultices, which were kept up for a month; even then the sloughs were not detached." It is satisfactory to find that no permanent harm was done; but it is evident that the excessive resistance recorded, amounting at times to 3500 ohms, was mainly due to this cause. It is perhaps not to be wondered at that the scientific Count should have relinquished this branch of his investigation.

With hands soaked in strong brine, and then enveloped in a thickness of flannel wetted with the same solution, bandaged surgically over this with a spiral strip of lead at least 30 cm. long and 5 cm. broad, no local accident has ever occurred to me, nor has any local pain been mentioned. But with ten bichromate cells in good order the shock felt at making and breaking circuit has often been considerable. Indeed my tall and athletic clinical clerk, Mr. Shackel, who kindly consented to act as a resistance, noticed that, when being tested from foot to hand (in his case a length of 7 feet) with 1027 ohms resistance, the opposite side of the body was jerked at these instants. In all recent experiments I have never exceeded this E.M.F., which is at the outside 20 volts, or about 18 volts as the cells run down.

In all cases hitherto named an ordinary battery current has been employed. In a paper read by me before the British Association at Southport, I named a rotating commutator and also one on the plan of a metronome which I had tried for the purpose of diminishing currents of polarisation by regular inversion. I preferred, however, the rapid manipulation of an ordinary commutating key with the fingers of the left hand until the "throw" of a damped galvanometer was all but extinguished.

At the Southport meeting, however, my friend, Dr. Oliver Lodge, suggested the use of alternating currents of induction, and a telephone in place of the galvanometer, and Prof. Lankester, the President of the Section in which my paper was read, kindly suggested that I should apply to the Royal Society for a grant in aid to purchase the expensive apparatus required for these experiments. The latter suggestion I at once acted on, and met with unconditional refusal on a printed form. Being thus thrown on my own small means, I proceeded to act on the former suggestion, and ordered an induction apparatus of an excellent London maker. But the British workman, if sure, is decidedly slow, and the instrument, though stated to be in a condition of forwardness, is not yet ready. In the meanwhile, in the pages of the *Electrical Review* for January 12, a diagram, description, and woodcut of a pretty little instrument designed by Prof. Kohlrausch of Wurzburg for the measurement of fluid resistances appeared; by his kindness I was put in communication with the firm of Hartmann and Co. of that town, the makers. They at once forwarded me the instrument, which proves to be beautifully made, and extremely moderate in price. This acknowledgment I owe to the Professor's courtesy towards a stranger, and their briskness in carrying out his wishes. Upon its details it is needless now to insist, it being practically a small induction-coil united to a metre-bridge of platinum-silver wire, with resistances of 1, 10, 100, and 1000 ohms, to be intercalated in the divided circuit. It emits a steady buzz of about 120 vibrations per second, which is reproduced in the telephone by methods well understood. In my first experiments I found the original and the phantom buzz difficult to separate. The former is easily lessened by mounting the apparatus on vulcanised rubber tubing and a solid support. The R. is read off the scale by inspection: towards the left hand or middle of the wire with great accuracy; towards the right-hand end the ohms get squeezed together. When I drew the plug of the 1000 R. my willing student-patient gave a jump out of his two brine baths and said he could not stand it. It was therefore necessary to use the 100 ohm plug. Even with this, however, the results were very remarkable. In this early period of my experiments two illustrative cases may be given. A female patient suffering from diabetes, but otherwise in good health, and able to walk about the ward, gave from foot to foot with an E.M.F. of 3·6 volts, a resistance of 1210 ohms; from right hand to right foot 1350 ohms; and from left hand to left foot exactly the same figure. With the induction current she gave from foot to foot only 473 ohms; from hand to foot 735 ohms on the right, and 750 ohms on the left, side. The difference was so great that at first I suspected instrumental error, but subsequent testings show that such is not the case. The discrepancy of 15 ohms between the two sides was clearly owing to my unfamiliarity with the telephone in place of galvanometer, and has materially lessened with greater experience.

A male patient suffering from dysentery, now perfectly well, gave from right hand to foot with a current of 3·6 volts a R. of 1580, with 6·2 volts a mean of 1510, with 18 volts a R. of 1366. Each observation was taken wice; the first and last agreeing exactly, the intermediate only differing from 1520 to 1500. This is impossible at times to prevent from the unintentional motions of the patient slightly shifting the level of the brine baths. With the same baths and poles the induction current gave only 590 ohms resistance.

In neither of these cases was there any morbid condition of the muscles tested. The distance was in each case from the external malleolus of the foot to the head of the ulna in the corresponding hand. In recording these results, I prefer, as on the former occasion, to give them at once in their rough state before waiting for a plausible explanation, or endeavouring to procure a fallacious agreement between the two methods. It is clearly not, as a writer in the *Electrical Journal* thought, a case of mere "cable-testing." What I stated then I now reaffirm, that there is some important difference of a physiological character between the human body as a conductor and ordinary fluid electrolytes.

No doubt, as Dr. Lodge suggests, "an alternating current ought to show too low a resistance, because of electro-chemical capacity, which it would treat like conductivity." But the difference is far too great for such an explanation, nor does it occur to this extent in saline solutions. I am at present engaged in testing its amount in physiological fluids, such as blood-serum, ascitic and ovarian effusion, and the like.

A beautiful metre-bridge on Prof. Kohlrausch's pattern, with platinum-silver wire of 3 m. long, has just reached me from Hartmann; with this I am using a "sledge" inductorium of Du Bois Reymond's with three different secondary coils of different lengths and fineness of wire. For the determination of the alternating currents passing I am using the small dynamometer with aluminium wire suspended coil which was shown before the Physical Society, and briefly described in NATURE.

This I shall check by a fine instrument now on its way from Wurzburg, with a single wire suspension and torsion head instead of the more sluggish bifilar method. Ultimately it may be necessary to use a quadrant electrometer.

Even at this stage it is obvious that the fact of the human body being about twice as permeable to induction as it is to low tension continuous currents is of great physiological and therapeutical importance.

W. H. STONE

INTERNATIONAL WEIGHTS AND MEASURES [1]

ALTHOUGH to some it might appear that the work of the Bureau at Sèvres is perhaps proceeding slowly, yet by reference to the two publications which have been issued under the authority of the Comité International it may be seen that the Bureau is doing its work thoroughly. The extent of the questions investigated is well shown in the first publication issued in 1881 (tome i.), which included papers by the director, Dr. Broch, on the force of gravity, the tension of vapour, the boiling point of water, and the weight of a *litre* of air; as well as independent investigations by Dr. Benoit on Fizeau's dilatometer; by Dr. Pernet, on thermometers; and by M. Marek, on weighing apparatus, &c.

The present publication (tome ii. 1883), to which we would now invite attention, contains accounts by Dr. Benoit of his expansion experiments; by M. Marek, on the methods and results of the weighings made at the Bureau from 1879 to 1881; and by Dr. Broch, on the expansion of mercury. In the experiments on the dilatation of standard measures of length, there has been followed a method attributed to General Wrede. It consists in the first instance in adjusting under two micrometer-microscopes a platinum-iridium bar, on which the

[1] "Bureau International des Poids et Mesures." *Travaux et Mémoires*, tome ii., 400 pp. Paris, 1883.

length of the metre has been marked by means of two fine lines. The position of the lines at a constant temperature is then determined by the micrometers, the bar being placed for this purpose in a trough of water, the temperature of which is maintained constant by an improved automatic regulator. A second metal bar, whose rate of expansion is to be determined, is placed in a separate trough of water, the temperature of which differs considerably from that in the other trough. This trough is then also brought into position under the microscopes, and the positions of the lines on the second bar determined relatively to those on the first bar. This method has the advantage that the results are independent of any change in the distance between the axes of the two microscopes during the comparison of the two bars. The optical effect of the immersion of the bars in water was investigated by M. Krusper in 1872–73, who found it to affect the comparisons very little.

The comparing apparatus at the Bureau was originally made by M. Sörensen of Stockholm, but was subsequently altered and improved by the Geneva Society for the construction of physical instruments, under the directions of M. Turettini. The lines on the bars were illuminated by light reflected on to a small mirror fixed at an angle of 45° inside the microscope, a little above the object glass. The determinations of the errors of each micrometer-screw throughout its whole length, for even no micrometer-screw has yet been made in which appreciable errors may not be detected in its use, was made in accordance with methods followed by Drs. Foerster and Hirsch, and MM. Starke and Kammerer.

The thermometers used were constructed after the form adopted by the Bureau (tome i. p. B 8), and were made at Paris by M. M. Baudin and M. M. Alvergnat. It is satisfactory to find that to the important question of thermometers the Bureau has given much attention, as in such investigations errors of thermometers are of as great importance as the errors of the micrometer-microscopes, but are not, however, always so carefully attended to as they should be. The thermometers were calibrated after the methods suggested by Dr. Thiesen and M. J. Marek ("Repertorium der Carl," t. xv. 1879), and were corrected for "exterior pressure" to a barometric height of 760 mm. at 0° lat. = 45°, as well as for "interior pressure," or vertical position, the thermometers reading from 0°·02 to 0°·06 C. too high when placed in a horizontal position.

During the past years this apparatus has been used in determining the rates of expansion of the platinum-iridium metres deposited at the Bureau, which are intended hereafter to be the universal standards or prototypes of the metric system. The linear coefficient of expansion for 1° C. of the platinum-iridium was found to vary from 0·000008668 to 0·000008689, with a probable error of only ± 0·0000000075.

The high accuracy of the results obtained at the Bureau in the weighings there executed, have been already previously referred to, as they appeared in a separate form in 1881. In the present volume M. Marek gives the particulars of the experiments made by him in redetermining the density of mercury of the kind actually used in barometer tubes, taking the mean density of mercury as being comprised between that of perfectly dry mercury and of mercury exposed to moist air. Illustrations are given of the modes of purifying and of weighing the mercury. The density of four samples of mercury, as determined by weighing in water, was found after many experiments to be as follows :—

Mercury	A =	13·595631 ± 0·000029
,,	B =	13·595633 ± 0·000024
,,	C =	13·595458 ± 0·000056
,,	D =	13·595930 ± 0·000055

In the paper, "Dilatation du Mercure," we find again that painstaking investigation and high accuracy which characterised the papers published in 1881 above referred to. The most exact observations on the dilatation of mercury are undoubtedly those of M. Regnault (*Mémoires de l'Académie des Sciences*, tome xxi. 1847); and it is to the mathematical reduction of these observations that Dr. Broch has now applied a critical examination, employing as his first coefficient of dilatation the value obtained by M. Wullner ("Lehrbuch der Experimental Physik," t. iii.) :—

$$d_t = 10^{-9}\,(181168 + 11{\cdot}554t + 0{\cdot}021187t^2),$$

instead of that of Regnault—

$$d_t = 10^{-9}\,(179007 + 25{\cdot}232t).$$

By a reduction by the precise method of least squares, of the original observations to the latitude of 45° at the level of the sea (B = 760 mm.), there is now obtained for the cubic expansion of mercury the following formula, which we would recommend to the attention of those engaged in accurate work :—

$$1 + kt = 1 + 0{\cdot}000181792\,.\,t + 0{\cdot}000{,}000{,}000175\,.\,t^2 + 0{\cdot}000{,}000{,}000035116\,.\,t^3.$$

We note that for the current year the President of the Bureau is General Ibanez (Madrid), the Secretary being Dr. Hirsch (Neuchâtel), the Committee including MM. Dumas (Paris), Foerster (Berlin), Gould (Cordoba), Govi (Naples), Herr (Vienna), Hilgard (Washington), Krusper (Budapest), Stas (Brussels), Wild (St. Petersburg), and Wrede (Stockholm). This country is not represented on the Committee, our Government having decided not to take part in this international project.

LILÆA[1]

THE genus *Lilæa* was founded by Humboldt and Bompland for a very curious plant closely allied to our native *Triglochin*, which was first found by them in New Grenada. The present memoir, which has apparently only recently reached Europe, is one of the most elaborate studies probably ever made of the entire morphology, histology, and development of a single flowering plant, and is due to the unexpected discovery of the plant in 1875 in the Argentine Republic. The curious reductions of structure which are the result of a more or less aquatic mode of life have always made plants of this kind attractive to investigators.

The careful investigation of the structure of the flower throws some light on a point which has been much controverted, whether the stamen is ever an axial structure or not. *Lilæa* bears its flowers in a spike, and there are no less than three kinds :—(1) below, female ; (2) in the middle, hermaphrodite ; (3) at the top, male flowers. These latter consist of a single stamen in apparent direct prolongation of the floral axis. It is about these in the similar cases of *Naias* that discussion has arisen. Now Hieronymus contends that this stamen is really only pseudo-terminal, but that it consumes in its development the primitive meristem of the growing point, and so eventually occupies its place. He extends the same explanation to the cases of *Naias, Zannichellia, Casuarina, Brizula*, and others which have been held to support the axial origin of stamens. But as Sachs remarks ("Textbook," second edition, p. 541), the question cannot be settled wholly on anatomical grounds. And in *Lilæa* there can be no doubt that in the hermaphrodite flowers the stamens are lateral. In the male flowers he sometimes finds a lateral rudiment of a pistil; and this must be held to clinch the argument that the stamen is not really cauline, but always lateral and only pseudoterminal.

Lilæa has a fourth class of flowers, the adaptive origin of which is interesting. The whole plant is at first partially submerged—perhaps was once wholly so. The

[1] "Monografia de Lilæa subulata." Por J. Hieronymus. *Actas de la Academia nacional de Ciencias en Córdoba.* (Buenos Aires, 1882.)

lowest flowers of the inflorescence are female, and seated in the axils of the sheathing leaves; but the style is enormously elongated so as to carry the stigma to the surface of the water for fertilisation. This recalls the habit of *Vallisneria*. But, as Mr. Bentham reminds us, the resemblances of *Hydrocharideæ* and of *Naiadaceæ* are essentially adaptive, and must not blind us to the real profoundly divergent affinity.

It is worth noting, as a hint to those interested in researches of this fascinating kind, that the investigations of Dr. Hieronymus were made partly on material preserved in a mixture of two-thirds alcohol and one-third glycerine, partly in an aqueous solution of salicylic acid (no further details are given). W. T. T. D.

PROFESSOR FLOWER

PROFESSOR FLOWER'S resignation of the office of Conservator of the Museum of the Royal College of Surgeons was received at the last meeting of the Council of that body, held on March 13, whereupon it was moved by Sir James Paget, seconded by Mr. Erichsen, and resolved unanimously:—"That the Council hereby desire to express to Mr. William Henry Flower their deep regret at his resignation of the office of Conservator of the Museum of the College.

"That they thank him for the admirable care, judgment, and zeal with which for twenty-two years he has fulfilled the various and responsible duties of that office.

"That they are glad to acknowledge that the great increase of the Museum during those years has been very largely due to his exertions and to the influence which he has exercised, not only on all who have worked with him, but amongst all who have been desirous to promote the progress of anatomical science.

"That they know that, whilst he has increased the value and utility of the Museum by enlarging it, by preserving it in perfect order, and by facilitating the study of its contents, he has also maintained the scientific repute of the College by the numerous works which have gained for him a distinguished position amongst the naturalists and biologists of the present time.

"And that, in thus placing on record their high appreciation of the services of Mr. Flower, the Council feel sure that they are expressing the opinion of all the Fellows and Members of the College, and that they will all unite with them in wishing him complete success and happiness in the important office to which he has been elected."

The conditions under which the Conservatorship of the Museum of the College will be held in future are at present under discussion, and will probably be decided at the next meeting of the Council on the 10th inst., when the office will be declared vacant, and candidates invited to send in their applications.

THE DEEP-SEA DREDGINGS OF THE "TALISMAN"—CRUSTACEA

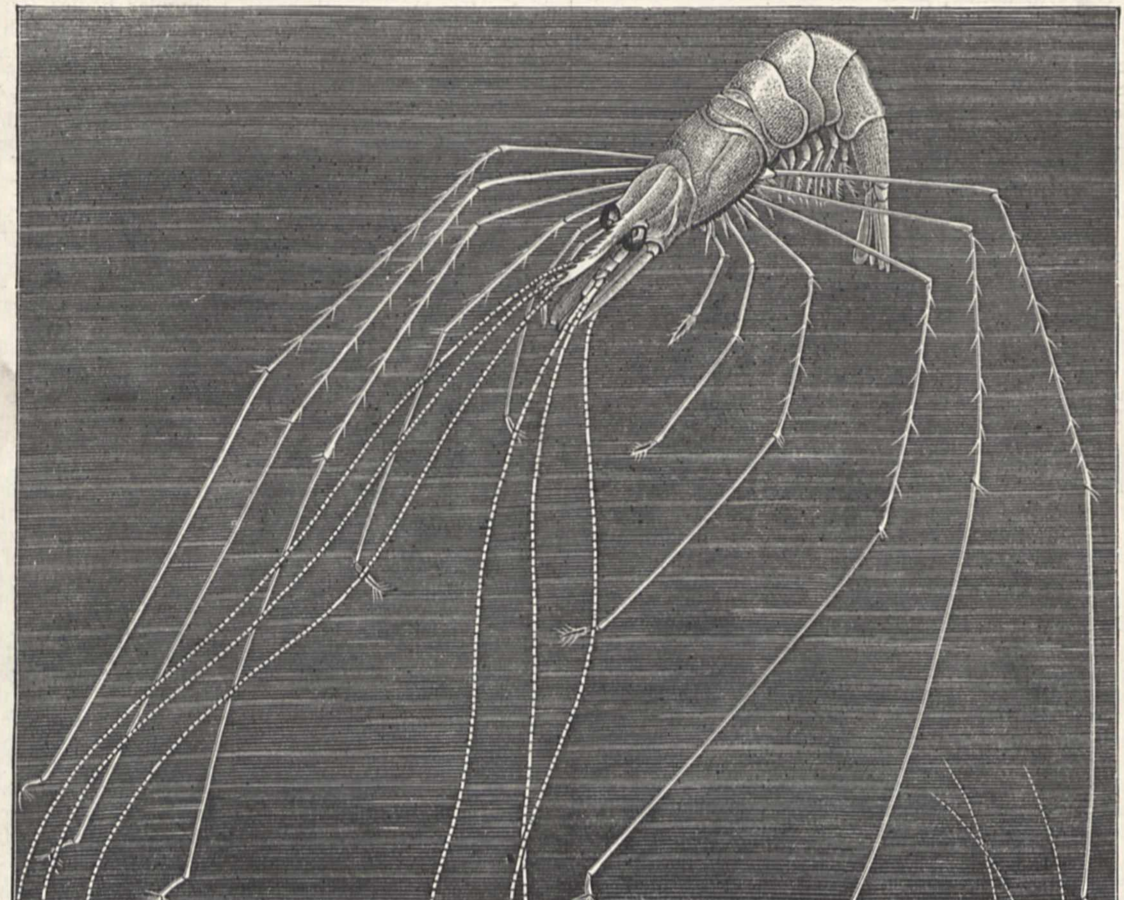
IN a previous article attention was called to some of the more remarkable of the deep-sea fishes taken during the recent cruise of the French frigate the *Talisman*: not less interesting were the numerous forms of Crustacea dredged during the same cruise, a fine collection of which were also on view at the Jardin des Plantes, Paris, as part of the spoils brought home after the voyage. From a survey of the specimens it is evident that these Crustacea are to be found at all depths of the ocean: some pass their lives floating on its surface, feeding thereon or amid the acres of Sargassum weed; while others live at depths of from 4000 to 5000 metres. The so-called swimming crabs which form a section of the Brachyura would seem to be extremely rare at great depths. Certain species taken during the *Talisman's* cruise are remarkable for their very extensive geographical distribution; thus, species of Batynectes which were found at depths of from 450 to 950 metres off the coasts of Morocco and about the Cape Verd Islands, seemed very closely related to the swimming crabs (Portunus) of our own seas, and again to be very nearly connected to species of the same genus collected at the Antilles, in the Mediterranean, and in the Arctic Ocean. Another section of the Brachyura, with sharp triangular bodies (Oxyrrhyncha), contains species which are to be met with at much greater depths; thus *Lispognatus thompsoni* (A. M. Edw.) was dredged off the coasts of Morocco from depths of between 600 and 1500 metres, and *Scyramathia carpenteri* was taken at the same place from a depth of 1200 metres. The former of these species has been found in the North Sea, and the latter has been taken off the north of Scotland and in the Mediterranean. The Crustacea intermediate by their forms between the Brachyura and the Macrura were found in abundance at very great depths, and the forms found seemed in great measure to belong to "transition" forms; so one was often surprised to find a form, which taken by itself appeared abundantly distinct, quite connected with others by numerous intermediary forms. Thus species of Ethusa, Dorippe, Homola, and Dromia seem to present such numerous shades of gradation as to perplex one completely in the difficult task of classifying these genera. Some of these forms are also very remarkable for their geographical distribution: a species of Dicranomia, described by Milne-Edwards from the Antilles, was found off Morocco, and *Homola cuvierii*, up to this thought to be peculiar to the Mediterranean, was found at the Azores and the Canaries. But the most remarkable instance of the geographical extension of which some genera are capable is furnished by some species of the family Lithodina. These Crustacea to this have been known as inhabitants of the Arctic and Antarctic regions, living in the littoral zone, but now they have been found under the tropics; the only difference being that in this latter locality they have contrived to find congenial conditions of life by abandoning their shallow-water life and betaking themselves to the cool depths of over 1000 metres. A fact like this is not without its interest, inasmuch as it shows how some forms can spread themselves from the frozen seas of the north to the seas of the tropics, and so from the region of one Pole to the other; altering their conditions of life as necessity demanded, and resuming their old habits when the opportunity to do so again occurred.

The Crustacea known as Hermit Crabs were found to extend to a depth of 5000 metres; as is well known, the terminal portions of the bodies of these Hermits are soft, not covered like the head and claws of the crab with a strong calcareous shell, and these animals have the habit of tucking the soft part of their bodies for security into the body-whorl of some empty shell; but at the great depths referred to shells suitable for this purpose are not to be found, and the hermit crabs inhabiting these depths must often be in great difficulties for material wherewith to cover themselves. In one specimen taken off Morocco this covering consisted of a living colony of a very pretty species of Epizoanthus.

Species of the family Galatheidea were found in profusion at all depths; but the colour of their body, generally that of a red or pink hue, was in the forms from the great depths of a uniform white. Some species were found which occupied the interior of those lovely siliceous sponges belonging to the genus Aphrocallistes. One new species, *Galathodes antonii*, was found at a depth of 4000 metres, and another, from the same depth, with its abdomen coiled twice upon itself, has been also described by A. M. Edwards as new (*Ptychogaster formosus*).

Of the group of Eryonidæ a considerable number of both genera and species were dredged. Of these, those belonging to the genera Polycheles, Wilmoesia, were from depths of from 4000 to 5000 metres, and the wonderful transparency of the forms permitted the whole internal viscera to be distinctly seen. Some species of Pentacheles were evidently allied to the fossil forms of Eryon.

Of the Crustacea belonging to the group of Macrura, the one to which the crayfish and shrimps belong, many were taken at very great depths. Off the Cape Verd Islands, from a depth of 500 metres, a thousand individuals of a new species of Pandalus were taken. Among the most remarkable of all of these forms is the one which, through the courtesy of the editor of *La Nature*, from which journal this notice is in part translated, we are enabled to give the accompanying illustration. Named *Nematocarcinus gracilipes* by Alphonse



Nematocarcinus gracilipes (A. M. Edw.).

Milne-Edwards, it was, when taken fresh from a depth of 850 metres, of a splendid rose colour. The extreme length of its antennæ will at once attract attention, and tno less remarkable are the wonderfully attenuated feet, of which the third, fourth, and fifth pairs are longer than the first and second. The eyes are large, but the eye-stalks are not elongated. In another member of this group, *Glyphus marsupialis*, the female had the lateral portions of the abdominal segments developed so as to form a pouch-like receptacle, in which the eggs were deposited.

When trying to draw conclusions from the phenomena presented by the numerous forms of Crustacea collected during the *Talisman* cruise, one is struck by the strange diversity in these phenomena. While some of the species are blind, others have well-developed organs of vision; while in some the eye-stalks are flexible, in others they are immovable; while in some there is a very marked transparency of the integuments and a decided softness of the muscular tissues, in others neither of these facts is at all apparent. Some of the deep-sea Crustacea are beautifully phosphorescent, and in certain species this phosphorescence is not diffused but is limited to some special areas of their bodies, and in a new species, *Acantephyra pellucida* (A. M. Edw.), the feet are adorned with phosphorescent bands. We of necessity know so little of the habits of these new, strange forms, that it would be premature to draw scientific conclusions from their structure.

THE SOCIETY FOR THE BIOLOGICAL INVESTIGATION OF THE BRITISH COASTS

THE meeting which we previously announced as about to be held for the purpose of inaugurating a new society having the above title, took place last Monday in the rooms of the Royal Society, Prof. Huxley being in the chair. The meeting was large and influential. Among those present were the Duke of Argyll, the Earl of Dalhousie, Lord Arthur Russell, Sir Lyon Playfair, M.P., Dr. W. B. Carpenter, Sir Joseph Hooker, the Hon. Edward Marjoribanks, M.P., Sir John Lubbock, M.P., President of the Linnean Society, Mr. J. Blake, M.P., Sir George Nares, Dr. John Rae, Sir Joseph Fayrer, Capt. Verney, R.N., Prof. Flower, Prof. Ewart, Dr. John Evans, Prof. Bonney, Dr. Spencer Cobbold, Mr. John Murray (of the *Challenger* Office), Dr. J. Gwyn Jeffreys, Dr. Günther, Prof. Moseley, Mr. G. J. Romanes, Mr. H. C. Sorby, Mr. Francis Galton, Mr. Brady, Prof. Crofton, Mr. Dawson Williams, Prof. St. George Mivart, Mr. Busk, Dr. Sclater, Dr. Dodson (Netley), Mr. Thiselton Dyer, Mr. H. C. Burdett, Prof. Donkin, Dr. John Murie, librarian of the Linnean Society, Mr. W. H. Dallinger, Dr. A. Geikie, Mr. E. Forbes Lankester, Mr. Saville Kent, Mr. M'Lachlan, Dr. Herbert Carpenter (of Eton), Prof. Jeffrey Bell, Mr. Frank Crisp, and Prof. Ray Lankester. Letters regretting inability to attend were read from Lord Derby, the Marquis of Hamilton, Sir Thomas Dakin, Mr. Chamberlain, Mr. Burdett-Coutts, Mr. R. W. Duff, M.P., and Dr. Dohrn.

Prof. Huxley, in opening the proceedings, began by observing that the object with which the meeting had to deal was not in his hands, but in those of Prof. Lankester, who had requested that the Royal Society should foster an undertaking which promised well for the progress of science. The establishment of marine biological stations had been undertaken during the last few years by most of the civilised countries, and was, indeed, a necessary result of the great change which had taken place in the aims of biological science. The study of development began about half a century ago, and the ramifications of that inquiry, which had been extended to the mode of becoming of all live things by Mr. Darwin, had caused a complete change in the methods of biological research. In order to investigate the living being it was now no longer deemed sufficient, as in the days of our great-grandfathers, to observe its outside, or even, in the days of our grandfathers, to examine its anatomy. We have now to trace its developmental growth from the egg, and we are able to do so with a thoroughness of which no one in his young days could have had any conception. Such was one good reason for founding an institution of this kind from a purely scientific point of view. But there was another reason from another point of view which was practical. We had great fisheries and great fishery interests, and up to within the last thirty years legislation with reference to them was almost entirely haphazard, owing to our ignorance of the habits, modes of life, reproduction, and so on, of marine animals which were economically useful. If we are to have any considerable improvement in our legislation in this respect, our arguments and reasonings with a view to it must rest upon sound and exact observation. In conclusion, he wished to say with special emphasis that there was no possibility of any rivalry between the society which it was now proposed to found and another society the formation of which was announced a few days ago by H.R.H. the Prince of Wales. That society was, in the ordinary sense of the word, practical. He trusted that when both societies were established, so far from there being any conflict between their aims, they would work in concurrence to a common end.

The Duke of Argyll said the resolution which had been placed in his hands was—"That in the opinion of this meeting there is an urgent want of one or more laboratories on the British coast, similar to those existing in France, Austria, Italy, and America, where accurate researches may be carried on, leading to the improvement of zoological and botanical science, and to an increase in our knowledge as regards the food, life, conditions, and habits of British food fishes and mollusks in particular, and the animal and vegetable resources of the sea in general." The fact of their being called together to form a voluntary society to carry out these objects implied a discovery on the part of those who had taken a leading part in this matter that the work was not likely to be taken up by the Government. He was afraid that in this respect the British Government had always stood rather behind those of other countries, whether monarchical or republican. There were other agencies by which facts about food fishes would be obtained, and he instanced the researches of the President of the Royal Society, and a valuable paper recently contributed by Prof. Ewart upon one of the most important questions connected with food fishes—the spawning of the herring. When further researches of this kind should be forthcoming, it can scarcely admit of doubt that, by making us acquainted with the life-history and habits of the herring, they will serve to improve the herring fisheries. He had himself good reason to appreciate the importance of acquiring information of this kind, for in the vicinity of his own residence the fishing community was suffering distress on account of the herring having abandoned Loch Fyne without any one being able, in the present state of our knowledge, to assign the cause. Moreover, the opposition which was raised to ground-trawling in Loch Fyne, on the supposition that the practice is destructive of herring spawn, has been shown by such researches to be without any justification—the spawn having been found to adhere closely to the sea-bottom. But great as would be the probable economic nature of a marine biological station in the improvement of our fisheries, he thought that the chief object in promoting this society should be that of promoting the interests of biological science. Enlarging upon the importance of this science, he concluded by observing that the branches of it which would fall to the lot of this society to cultivate would have the advantage of avoiding contact with the question of vivisection; for he supposed that even the most susceptible of anti-vivisectionists would scarcely have their feelings touched by physiological experiments on jelly-fish.

Sir Lyon Playfair, M.P., in seconding the resolution, dwelt upon the anomaly that a country which depends so much upon its fisheries as Great Britain should hitherto have been the only Great Power which had not founded a zoological station. He then proceeded to enumerate some of the economic advantages which had been secured by such institutions elsewhere, especially in America.

Lord Dalhousie and Prof. Flower also supported the motion.

Dr. W. B. Carpenter moved:—"That it is desirable to found a society, having for its object the establishment and maintenance of at least one such laboratory at a suitable point on the coast, the resources of the laboratory its boats, fishermen, working-rooms, &c., being open to the use of all naturalists under regulations hereafter to be determined."

Sir John Lubbock, as President of the Linnean Society and a trustee of the British Museum, in seconding this motion said he thought they owed their thanks to Prof. Lankester for the efforts he had made to found the proposed society.

Dr. Günther supported the resolution, which was passed.

Sir Joseph Hooker moved:—That this meeting does hereby agree to constitute itself such a society under the title of "The Society for the Biological Investigation of the Coasts of the United Kingdom." He dilated upon the importance of such a society to the interests of botanical science. The motion was seconded by Prof. Moseley, who appropriately called attention to the fact that most, if not all, life upon this planet was littoral in origin, and afterwards spread on the one hand to the deep sea and on the other to the land.

On the motion of Sir William Bowman, F.R.S., it was resolved that gentlemen whose names follow be requested to act as a provisional council and report to an adjourned meeting to be held on Friday, May 30, as to the constitution and organisation of the society and other matters, and in the meantime have power to admit suitable persons to the membership of the society; further, that Prof. Lankester be asked to act as secretary and Mr. Frank Crisp as treasurer *ad interim*. Those named were the Duke of Argyll, the Earl of Dalhousie, Lord Arthur Russell, the Lord Mayor, the Prime Warden of the Fishmongers' Company, the President of the Royal Society, the Presidents of the Linnean, Zoological, and Royal Microscopical Societies; Dr. W. B. Carpenter, F.R.S.; Mr. W. S. Caine, M.P., Mr. Frank Crisp, Mr. Thomas Christy, Mr. Thiselton Dyer, F.R.S., Prof. Flower, Mr. John Evans (treasurer of the Royal Society), Dr. Albert Günther, F.R.S., Sir Joseph Hooker, Prof. Michael Foster (secretary of the Royal Society), Prof. Ray Lankester, F.R.S., Prof. M. Marshall, Prof. Moseley, F.R.S., Mr. John Murray, F.R.S.E., the Rev Dr. Norman, Mr. George J. Romanes, F.R.S., Prof. Burdon Sanderson, F.R.S., Dr. Sclater, Mr. Adam Sedgwick, Mr. Percy Sladen, Mr. H. C. Sorby, F.R.S., and Mr. Charles Stewart, F.L.S.

Mr. G. J. Romanes, in seconding the motion, took occasion to observe that in his opinion one of the most important functions of the society when formed would be that of conducting researches upon invertebrate physiology. He was sure he would be but carrying with him the assent of all physiologists when he said that it is to the invertebrate forms of life that we must now look for the elucidation of many of the most fundamental problems connected with life-processes. It is in the Invertebrata that we meet with life in its least compounded state, and therefore in the state best suited to observation and experiment directed towards the solution of these fundamental problems. The sea is the great magazine of invertebrate life, and if the rich stores of material therein presented have been hitherto almost entirely neglected by physiologists, the explanation may be found in the fact that physiological research can only be conducted in well-equipped laboratories, which have been of but comparatively recent institution upon the sea-coasts of Europe and America.

Prof. Ray Lankester then moved a vote of thanks to the President of the Royal Society for taking the chair, and said it had been estimated that from 6000*l.* to 10,000*l.* would be required to start the project. He invited immediate subscriptions, payable *ad interim* to the treasurer, Mr. Frank Crisp, 6, Old Jewry, E.C. Sir Joseph Fayrer seconded the motion, and the President having briefly replied, the proceedings terminated.

NOTES

In the death of the youngest and one of the most accomplished of the Queen's sons the cause of education has sustained a loss. The Duke of Albany knew well what science meant, and on several occasions publicly expressed his sense of its value in respect of the nation's welfare, and the necessity for its introduction into our systems of education. There can be no doubt that had he lived he would have rendered service to the best interests of the country. It is so rarely that princes have the tastes and leanings of the late Royal Duke that we could ill afford to lose him.

The organising committee of Section F (Economic Science and Statistics) have arranged the following programme of subjects for discussion at the Montreal meeting of the British Association. The subjects will be distributed over the four or five days which will probably be at the disposal of the Section. Group I. Population: (1) Emigration; (2) Census results; (3) Distribution of wealth and condition of the poor. Group II. Land: (4) Agriculture; (5) Land laws; (6) Forestry. Group III. Trade: (7) Manufactures, shipping, and foreign markets; (8) Internal communication by land and water. Group IV. Finance: (9) Monetary system; (10) Public debts (Governmental and Municipal). Writers have been engaged for most of the subjects in the above programme.

We regret to announce the death, at the age of sixty-seven years, of Mr. Nicolas Trübner, the well-known publisher, who has done so much to place within the reach of the English public some of the best works in German philosophy, science, and learning. He will be missed by a wide circle of friends, among whom are many men of science, English and foreign.

The Prince of Wales has formally urged upon the Corporation and the Livery Companies to lend still further aid to the City and Guilds of London Technical Institute, which is greatly in need of funds; and the Corporation proposes to vote a further sum of 1000*l.* provided the Livery Companies subscribe the rest of the 20,000*l.* needed by the Institute.

As usual there was some pleasant talk at the Civil Engineers' dinner last week; Prof. Huxley in replying to the toast of "Science," said there was one educational aspect which was extremely instructive and important, and that was the insensible and almost unconscious education in science which was carried on upon the masses of the people by the great work of engineers and mechanicians. The work of the engineer and all who were applying the teachings of science was surrounding the population with the symbols of scientific faith.

Mr. W. Saville Kent, F.L.S., F.Z.S., has been appointed Inspector of Fisheries to the Government of Tasmania, and proceeds shortly to the scene of his new duties. The more extensive introduction and distribution of the Salmonidæ already acclimatised in Tasmanian waters, and the resuscitation by artificial culture of the once prolific but now greatly depleted oyster fisheries, are among the special subjects that will engage the attention of the newly appointed Inspector. A systematic investigation of the marine fauna, with the view of turning to profitable account those edible, indigenous forms which are as yet but little utilised for economic purposes, will likewise be initiated. It is to be hoped that the Colonial Government will recognise the fitness of the opportunity that now presents itself of establishing in this quarter of the antipodes a well-equipped if small marine observatory for the artificial cultivation and scientific observation of the habits and developmental phenomena of the many interesting types peculiar to this region, and of which, as yet, biologists possess little or no knowledge. Mr.

Saville Kent's reputation as a marine zoologist, and the experience he has already gained as naturalist to various of the large public aquaria of this country, peculiarly qualifies him for the conduct of original investigation in this new field, which could not fail to yield important results for both the interests of science and the fishing industries of Tasmania.

THE Institution of Naval Architects is meeting this week. The session was opened yesterday under the presidency of the Earl of Ravensworth. The papers down for yesterday were:—On the Riachuelo, by J. D'A. Samuda; description of the electrical launch built last year, by A. F. Yarrow; on the vibration of steam vessels, by Otto Schlick. To-day the following papers will be read:—On cross curves of stability, their uses, and a method of constructing them, obviating the necessity for the usual correction of the differences of the wedges of immersion and emersion, by William Denny, F.R.S.E.; the use of stability calculations in regulating the loading of steamers, by F. Elgar, Professor of Naval Architecture, University of Glasgow; on a new method for calculating, and some new curves for measuring the stability of ships at all angles of inclination, by M. Daymard; on some points of interest in connection with the construction of metacentric diagrams, and the initial stability of vessels, by P. Jenkins; on the combustion of fuel in furnaces of steam boilers by natural draught and by air supplied under pressure, by J. Howden; on the application of hydraulic machinery to the loading, discharging, steering, and working of steamships, by A. B. Brown; cast steel as a material for crank shafts, &c., by J. F. Hall; repairs to steamship machinery, by Andrew K. Hamilton. To-morrow the following are set down for reading:—Contributions to the solution of the problem of stability, by L. Benjamin; on the uses of Amsler's integrator in naval architecture, by Dr. A. Amsler; on the comparative safety of well-decked vessels, by Thomas Phillips; the graphic calculation of the data depending on the form of ships required for determining their stability, by J. C. Spence; description of Alexander Taylor's stability indicator, for showing the initial stability and stowage of ships at any displacement, by A. Taylor; some considerations relating to the riveting of iron ships, by H. H. West; on the ventilation of merchant steamers, by J. Webb; on water brakes, by Capt. F. J. Heathorn, R.A.; on improvements in apparatus and means for indicating the position of a ship's helm, by J. E. Liardet.

THE Geographical Society of Bremen publishes in vol. vii. part I of its *Deutsche Geographische Blätter* an interesting paper, by Dr. A. H. Post, on the development of family life among mankind from an original "matriarchal" condition. He brings forward some new evidence collected by Dr. C. A. Wilken in the Dutch East Indies, showing the existence of Malay families consisting of mothers and their children, to which the fathers do not belong as members at all, being in fact only visitors. Dr. Post, tracing the stages of progressive change under the influence of landholding and the union of individuals in states, which in the course of ages converted matriarchal into patriarchal society, expounds with much clearness the theory which has arisen in the last few years out of the works of Bachofen and McLennan. Some of this clearness arises no doubt from ignoring difficulties, but a sketch of this kind does not involve the responsibilities of a full-grown treatise.

THE International Health Exhibition will be opened by the President, the Prince of Wales, on Thursday, May 8, at 3 p.m.

THE death is announced of Dr. George Engelmann, the well-known botanist, who died at St. Louis on March 3, aged seventy-five. Also of Dr. Siegfried Aronhold, formerly Professor of Natural History at the Berlin Technische Hochschule, who died at Berlin on March 13.

NEWS from the Austrian traveller, Eduard Glaser, who had fallen dangerously ill, states that he has recovered, and left for Haschid on February 6, a part of Arabia hitherto unexplored by Europeans.

M. GABRIEL DE MORTILLET, Conservateur of the Museum of National Antiquities at St. Germain, has begun to issue a new monthly journal, *L'Homme*, entirely devoted to anthropology.

M. FREMY, Director of the Museum of Paris, has published a pamphlet defending the establishment against the Central Administration, which is desirous of appointing a director. Up to the present time the director has been nominated by his fellow professors. This liberal mode of nomination was established by the National Convention in 1793. It is probable that an effort will be made in the present session to extend this privilege to other establishments, as the Observatory and the Conservatoire des Arts et Métiers.

M. FREMY is desirous of establishing on the coast a marine laboratory in connection with the Museum of Paris. It is thought the money may be granted for establishing one in Algeria.

THE motion proposed by Admiral Mouchez to sell the Paris Observatory ground, has been defeated before the Academy of Sciences by a large majority. Only two members, MM. d'Abbadie and Faye, voted with the Admiral.

A CORRESPONDENT referred last week to the changes which have been introduced into the examinations for admission into the Royal Military College, and the subject was brought up in the House of Lords last Thursday by Lord Salisbury. "The change with respect to natural science," he said, "was much to be regretted, because there was no body of men to whom a knowledge of science could be more useful, and conduce more to their happiness, especially when it was considered that they had to pass their time in various parts of the world, often with no adequate employment for their spare hours." The Earl of Morley in reply said that "by the new scheme greater importance was given to modern languages and mathematics, less importance to science, and the English paper had been excluded from Class I. The object of these changes was to improve the examinations, and to encourage the subjects which must be taught. In drawing up this scheme the War Office had been in constant communication with the Civil Service Commissioners, and with many gentlemen interested in education. The main purpose of these examinations was to test the results of general education, and for that purpose the subjects themselves had, as far as possible, to be of a general nature. That constituted one of the evils of the present system. He did not think it was necessary, or even desirable, in framing a scheme of this kind to confine themselves to the curriculum of the public schools. It was, no doubt, a matter of regret that during the last five years the number of successful candidates who came direct from the public institutions to the Royal Military College had diminished rather than increased. He did not wish to speak harshly of the race of private tutors. Some of them were extremely able and ingenious, but as a rule their whole object was mark-making. These tutors did not require their pupils to read the books on which they were examined, but by an ingenious process of analysing their contents all the questions that could be put to them could almost be exhausted. But cram did not last, and it was no substitute for education." The Duke of Cambridge said that "the great object of the examination was to put forward such a syllabus that all young persons educated at the public schools of the country should be able to enter Woolwich or Sandhurst direct without going through the hands of the crammer. What was wanted to bring about this result was a general education which they could say every young gentleman ought to have to fit him for any sphere in life which he might intend to adopt. It would be time enough to teach military subjects when the candidates for the army got into the military schools. Up to that time their education should be general, and not special. The proposed change was entirely with the view of inducing the public schools, such as Wellington, Marlborough, and others, besides Eton and Harrow, to co-operate with the authorities in the endeavour to get rid of cramming." The Marquis of Salisbury believed that "nothing would ever get rid of cramming so long as there was a system of competitive examination. Cramming belonged to competitive examination. He ventured to say that the Government were pursuing their object in rather a dangerous way. If there was a difference between the great public authorities and the public schools, the former should lead. With respect to the question of English literature, he did not understand why boys should not be expected to get a general knowledge of it in the same way that they were expected to have a general knowledge of Latin literature. In France and Germany the language, literature, and history of the country were systematically studied, but we seemed to treat them as matters of no importance, or as things which might be learnt in the nursery, or accidentally in conversation after leaving school."

THE Ninth Annual Meeting of the members of the Sunday Society was held at 9, Conduit Street, W., on Monday last, Prof. W. H. Corfield, M.D., in the chair. The annual report, which was read by Mr. Mark H. Judge, Honorary Secretary, set forth the work of the Society during the past year. It referred at considerable length to the action taken in the House of Lords, and pointed out that the policy embodied in the resolution proposed this year by Lord Thurlow at the request of the National Sunday League differed from that advocated by Lord Dunraven and other representatives of the Sunday Society in both Houses of Parliament. Statistics of the Society's Sunday Art Exhibitions were given. The movement in the provinces had been successful at Newcastle-on-Tyne, the Public Library there having been opened on Sundays by the Town Council. His Grace the Duke of Westminster was elected President of the Society.

TWO shocks of earthquake were felt at San Francisco in the afternoon of March 25. The series of earthquakes which began on the 25th ult. continues in the south of Hungary. In Vukovar some slight shocks were again felt on March 27 at 11 p.m. On the night of the 29th about sunset a pretty severe shock of earthquake was felt at Sinope and other places in the neighbourhood. In the town of Costamboul some old buildings fell, but no lives were lost.

THE Easter Monday and Tuesday excursion of the Geologists' Association this year will be to Lincoln; on Saturday, April 26, there will be an excursion to Guildford.

THE number of high-level meteorological stations has been recently increased by the opening of a station at Poni, on the Suram Pass of the Great Caucasus.

MR. CHARLES SMITH, Fellow and Tutor of Sidney-Sussex College, Cambridge, to whose valuable treatise on "Conic Sections" we have already drawn attention, has prepared a new elementary mathematical work which will bear the title, "An Elementary Treatise on Solid Geometry." It will be published almost immediately by Messrs. Macmillan and Co.

THE additions to the Zoological Society's Gardens during the past week include two Malbrouck Monkeys (*Cercopithecus cynosurus* ♀♀) from West Africa, presented by Messrs. G. Somerford and G. A. Zobel; an Axis Deer (*Cervus axis* ♀) from India, presented by Mr. L. B. Lewis; a Bosman's Potto (*Perodicticus potto*) from West Africa, presented by Capt. Grant Elliott; a Common Squirrel (*Sciurus vulgaris*), British, presented by Mr. P. Aug Holst; three Herring Gulls (*Larus argentatus*), European, presented by Mr. S. Aloof; a Rose-crested Cockatoo (*Cacatua moluccensis*) from Moluccas, presented by General Rundall, R.E.; a Grecian Ibex (*Capra ægagrus*), South-East European, presented by Mr. Thomas B. Sandwith; a Smooth Snake (*Coronella lævis*), British, presented by Mr. W. H. B. Pain; a Greater Sulphur-crested Cockatoo (*Cacatua galerita*) from Australia, a Rose-coloured Pastor (*Pastor roseus*) from India, deposited; a Leopard Tortoise (*Testudo pardalis*) from South Africa, an Egyptian Cobra (*Naia haje*) from Africa, purchased; a White-fronted Lemur (*Lemur albifrons*), a Vulpine Phalanger (*Phalangista vulpina*), born in the Gardens.

OUR ASTRONOMICAL COLUMN

THE DOUBLE-STAR α HERCULIS.—Smyth, in his "Cycle of Celestial Objects," attributes to Sir William Herschel the discovery of the duplicity of this star; but the companion was detected two years earlier than Sir William's first observation, and under somewhat curious circumstances. It was perceived by Maskelyne while observing the meridian passage on August 7, 1777, and only seven days later Christian Mayer, also observing the transit of the star with his mural quadrant, noted it to be double. The particulars are detailed in Mayer's work, "De Novis in Cœlo Sidereo Phenomenis," published at Mannheim in 1779. He had communicated to Maskelyne a number of his results bearing upon the double-stars; and the Greenwich astronomer, in replying towards the end of 1777, relates that he had observed a similar phenomenon in α Herculis on the date given above, "et videns valde obstupui," he remarks, since he had so often observed the star on the meridian without perceiving the companion. Maskelyne considered it of the sixth magnitude, the principal star being estimated a third; the latter he judged to be reddish, and the companion pale; Mayer, who discovered the smaller star on August 14, called it a seventh or eighth magnitude.

Adopting Sir George Airy's intervals for the transit-wires in Maskelyne's instrument, we find from a number of transits of the two components—

For about 1778·2 ... $\Delta\alpha$ ... + 0·324s, $\Delta\delta$ ... − 2″·80.

And hence the angle of position 120°·8, and the distance 5″·47.

Mayer's observations extend from August 14, 1777, to August 26, 1779. His differences of right ascension vary from 0·75s. to 0·2s., and those of declination from 6″ to 1″·8, while his estimates of the magnitude of the smaller star vary from 6 m. to 8·9.

Sir William Herschel's first measures were made on August 29, 1779. Taking means of those made between this date and 1783·252, we find—

Position, 1782·36 ... 116°·9 Distance, 1780·33 ... 4″·88.

VARIABLE STARS.—Mr. Burnham, in a note to No. 545 of his recently published Catalogue of 748 double-stars, remarks: "The principal star is strangely wanting in many of the star catalogues." It was observed by Lamont in zone 364, and estimated 5 m.; it does not occur in Lalande, D'Agelet, or Bessel. On Bremicker's Berlin map it is marked 7 m., and it is 6 m. in Harding's Atlas. In the *Uranometria Argentina* it is called 6·3; Gould has no note upon it. We have also the following estimates:—

1879·345	Burnham	6·5
— ·549	Stone (Cincinnati)	7·5
— ·575	Burnham	6·5
1880·442	Stone	6·0
— ·520	Burnham	5·5
1881·383	,, ...	6·5
— ·578	,, ...	6·8

The star may perhaps vary from about the fifth to the seventh magnitude, but systematic observation is wanted to decide. Its position, brought up from Lamont to 1885·0 is in R.A. 17h. 8m. 46·9s., N.P.D. 104° 27′ 4″.

D'Agelet 5057 (a star to which attention has been already called in this column) deserves frequent examination. It was observed by D'Agelet on July 26, 27, and 29, 1783, being twice noted 6 m. and once 6·5. It was not observed either by Lalande or Bessel, but in the *Durchmusterung* we find it estimated only

9·4. Its place for 1885·0 is in R.A. 19h. 27m. 35·5s., N.P.D. 72° 29′ 54″.

Nos. 2577–78 of the *Astronomische Nachrichten* contain the late Prof. Julius Schmidt's results of observations of variable stars made at Athens in 1883, which were communicated about a fortnight before his sudden decease.

ON THE AURORA BOREALIS IN ICELAND

AS considerable doubt has hitherto prevailed as to the form and nature of the aurora borealis in Iceland, I have decided to pass the winter here in Reykjavik, in order to study the phenomenon on principles which I followed during my sojourn at Kautokeino last winter, 1882–83 (NATURE, vols. xxvii. p. 394, and xxviii. p. 397).

I arrived here about the middle of October last, and began my regular observations on November 6; and although the series of observations as yet is brief, and, through very unfavourable weather, not so complete as might be desired, I believe that a few preliminary remarks on this phenomenon may not prove without interest, particularly as the appearance of the aurora borealis here is somewhat different to what we might expect and what is generally assumed.

Weather more unfavourable than I have encountered since my arrival it is impossible to imagine. A sky nearly always cloudy, rain, snow, and storm following upon storm—such have its chief characteristics been. A clear sky is quite an exception, and when it occurs there is a wind blowing so keen and cutting that no human being can walk out of doors for any length of time. Iceland is, no doubt, not favoured with very congenial weather, but such a winter as the present must, according to the dwellers here, be considered as quite an exceptional one.

I have shown in Table I. the average cloud calculations of each evening hour (the observations begin generally at 5 p.m., and continue until two or three hours after midnight) from November 6 to January 28. Here 5 indicates the hour from 5h. to 5h. 59m., &c. The scale is the usual one, viz. from 0 (clear) to 10 (cloudy).

TABLE I.

Hour	5	6	7	8	9	10	11	12	13	14	15	Average
Clouds	8·06	7·72	7·51	7·83	7·90	8·10	8·24	8·0[illegible]	7·39	8·29	8·66	7·91

If an average of the nebulosity on each evening be taken, each value of the scale will fall on the number of days shown in Table II. The former are also calculated in per cents. of the total days (83).

TABLE II.

Clouds ...	0	1	2	3	4	5	6	7	8	9	10
Days ...	2	8	2	1	4	1	1	9	9	15	31
Per cent.	2·4	9·6	2·4	1·2	4·8	1·2	1·2	10·8	10·8	18·1	37·3
	14·5			7·2			22·9			55·4	

These figures speak so plainly for themselves that any comment is needless.

Through Iceland being situated in the zone of the terrestrial magnetism, it might be assumed that the aurora borealis attained a high degree of development and splendour here; but this has not been the case this winter, in Reykjavik at all events, even allowing for the unfavourable weather. The auroræ here are generally faint and wanting in force; it is only seldom that there is any energy in the movements, and but rarely that the forms are sharply defined, while the outlines are dim and vague.

There have therefore only been a few occasions on which I have been able to effect somewhat satisfactory measurements with the auroral theodolite of azimuth and the height. The aurora doubtless often reaches far up on the sky, and even travels far down on the southern horizon, but the force of light is very small. In spite of the circumstance that Reykjavik lies—judging by the appearance of the aurora borealis on the horizon—much nearer to the auroral maximum zone than Kautokeino, the appearance of the auroræ in the two places cannot be compared. There was activity, force, and colour; here is vagueness, uncertainty, and want of character. Only once—on January 25—I observed an aurora during one hour which was a true Arctic one, with defined, elegant outlines, intense play of colour, and bold movements.

The more extensive auroræ which I saw in Kautokeino generally finished by the bands or streamers changing into luminous clouds, which again shortly afterwards assumed the wave-like motion I have called "coruscation," and which often lasted for hours, flooding the entire heavens. This form of the aurora borealis *I have not observed on a single occasion here*, which appears to me to be a very remarkable circumstance. Extensive auroræ finish here through the simple vanishing of the light or by the changing of the forms into faint, luminous clouds consisting of stripes (north-east to south-west), or vague, cloudy bands which by degrees lose in energy and finally die away.

Any real corona I have not seen as yet, and the usual colours, viz. red and green, I have only noted on six occasions.

On forty of the eighty-three evenings I have effected observations there have been auroræ, which is rather a high figure when the unfavourable weather conditions are taken into consideration. But the aurora is, however, not always present when the sky is clear or nearly so; on the contrary, it is not nearly as frequent here as in Kautokeino. This will be understood from Table III., which has been framed on the assumption that all observations were equally divided over the twelve hours, viz. from 4h. to 15h., which also shows that in every hour there was observed one hundred times either aurora or clear sky without aurora. The lower figures show in per cents. when the sky was without aurora.

TABLE III.

Hour	4	5	6	7	8	9	10	11	12	13	14	15
W	75	72	77	88	91	97	89	83	63	53	62	33
o	25	26	23	12	9	3	11	17	37	47	38	67

In consequence of the great magnetic declination in Iceland, viz. about 40° N.W., the points of culmination of the arcs and bands fall far outside the astronomical meridian, and their direction is nearly north-east to south-west. From the measurement of twenty arcs, partly on the north, partly on the south horizon, I have certainly only obtained an azimuth of 22°·4 W., but I do not accept this as any definite result before more complete observations are in my hands.

The intensity of the aurora borealis here I have defined approximately in Table IV. by four degrees, viz. from one to four. From the total determinations of intensity for every hour when no aurora is visible, in spite of clear sky, being determined by 0, the following average figures are obtained:—

TABLE IV.

Hour	5	6	7	8	9	10	11	12	13	14	15	Average
Intensity	0·90	0·76	1·04	1·26	1·45	1·05	0·82	0·59	0·40	0·44	0·03	0·95

From these figures a decided maximum of intensity is manifest between 9h. and 10h.

As regards the position of the auroræ on the sky and the relative frequency of the various forms, I append a tabular list of observations. The abbreviations made in the same are these:—

H N. Aurora stands near the northern horizon, *i.e.* the magnetic north.
l N. ,, ,, low in the north.
N. ,, ,, in the north (to a height of about 45°).
N h. ,, ,, on the northern horizon (to a height from the horizon about 70°).
N h—Z. ,, ,, on the northern horizon to zenith.

Further, *Z* indicates through or on both sides of the zenith *S*, south; *S Z*, south of zenith; *S h*, south horizon; *t*, over the whole sky; ÷, with the exception of; *N* + *S*, auroræ in the north and south (but not in zenith); 0, no aurora. Below *N′* I have collected the values of *H N*, *l N*, *N*, *N h*, and *N h—Z*; and under *S′* those of *S Z*, *S h*, and *S*; and under *t′* the others, with the exception of 0.

Table V. gives percentally, assuming an evenly divided time of observation, a view of the position of the auroræ in the sky.

Table VI. shows the relative appearance of the various forms calculated percentally on the same basis as in the previous tables. Here *I* indicates one arc; *I*=, several arcs; *II*, a band; *II*=, several bands; *j*, diffused; *s*, streaming; *js*, simultaneously diffused and streaming, or a variety between the two; *III* isolated streamers, or bunches of streamers; *V*, luminous clouds

TABLE V.

Hour	4	5	6	7	8	9	10	11	12	13	14	15	Average
HN	0	0	0	0	0	3	4	13	5	0	0	0	2·2
IN	0	11	14	14	22	12	25	22	11	11	0	0	15·0
N	8	37	31	26	22	19	21	9	11	0	0	33	19·8
Nh	8	5	6	2	3	0	7	0	0	0	0	0	2·9
Nh–Z	8	0	3	12	9	9	7	0	0	5	13	0	6·2
Nh–SZ	8	5	6	12	16	19	4	9	5	11	25	0	10·3
Z	0	0	0	2	6	0	7	0	0	5	13	0	2·6
SZ	0	0	3	2	0	3	0	0	0	0	0	0	1·1
Sh	8	0	0	5	0	0	0	0	0	0	0	0	1·1
S	8	0	0	2	0	3	4	0	5	0	0	0	1·8
t÷(N+S)	8	0	3	0	3	6	0	0	5	0	0	0	2·2
t÷lS	0	5	0	2	3	9	4	9	5	16	0	0	4·8
t÷lN	0	0	0	2	0	0	0	0	0	0	0	0	0·4
N+S	8	0	6	2	6	3	4	9	5	0	0	0	4·0
t	8	11	6	5	0	6	4	13	11	5	13	0	6·2
0	25	26	23	12	9	3	11	17	37	47	38	67	19·4
N′	25	53	54	53	56	47	64	43	26	16	13	33	46·2
S′	17	0	3	9	0	6	4	0	5	0	0	0	4·0
t′	23	16	20	26	34	44	21	39	32	37	50	0	30·4
S′+t′	50	16	23	35	34	50	25	39	37	37	50	0	34·4

TABLE VI.

Hour	4	5	6	7	8	9	10	11	12	13	14	Total
Ij	3·3	3·3	4·6	5·5	4·0	2·9	2·9	0·8	2·2	1·3	0	30·8
Is	0	0	0	0	0	0	1·4	1·7	1·1	0	2·0	6·2
Ijs	3·3	1·1	1·5	1·0	2·0	2·4	0·7	2·5	2·2	1·3	0	18·0
IIj	0	0	0	1·5	0	0	0·7	1·7	1·1	1·3	2·0	8·3
IIs	0	0	0·8	0	0	0·6	1·4	0	0	1·3	0	4·1
IIjs	0	0	0	1·5	2·7	1·2	0	0·8	1·1	1·3	0	8·6
III	0	0	0·8	2·5	0·7	0·6	0·7	3·3	1·1	1·3	0	11·0
V	0	2·2	1·5	1·5	1·3	1·2	2·1	2·5	3·3	5·0	2·0	22·6
I=j	0	1·1	2·3	1·0	0·7	1·2	0·7	0	0	0	0	7·0
I=s	0	0	0·8	0	0·7	0	0	0·8	0	0	0	2·3
I=js	3·3	4·4	1·5	2·5	2·7	2·9	3·6	2·5	2·2	1·3	0	26·9
II=j	0	0	1·5	1·5	0	0	0·7	1·7	0	0	4·0	9·4
II=s	3·3	0	0·8	0	0·7	0·6	0·7	0	1·1	0	2·0	9·2
II=js	6·7	4·4	2·3	3·0	4·0	3·5	2·1	0·8	0	0	0	26·8
I	10·0	10·0	10·8	10·0	10·0	9·4	9·3	8·3	7·8	3·8	2·0	91·4
II	10·0	4·4	5·4	7·5	7·3	5·9	5·7	5·0	3·3	3·8	8·0	66·3
j	3·3	4·4	8·5	9·5	4·7	4·1	5·0	4·2	3·3	2·5	6·0	55·5
s	3·3	0	2·3	0	1·3	1·2	3·6	2·5	3·3	1·3	4·0	22·8
js	13·3	10·0	5·4	8·0	11·3	10·0	6·4	6·7	5·6	3·8	0	80·5

On the valuable isochasme chart, in which Prof. Fritz has denoted the increasing frequency of the aurora borealis northwards, the maximum zone of the phenomenon falls far south of Iceland. I must, however, first explain what my definition of the word maximum zone is at present. It is a line passing across the places where the aurora not only appears and is most frequently visible, *provided the weather permits*, but where it also, as a rule, appears in zenith, or as often on the northern as the southern hemisphere. According to this definition, the correctness of which I think can neither be disputed nor doubted, Iceland lies, at all events this year, as was the case with Kautokeino and Bossekop last year, considerably south of the maximum zone, which is, in fact, clearly shown in Table V.

I hope to be able to demonstrate this in a more conclusive manner still on a future occasion, when the winter is over and the numerous exact determinations of the southern border of the aurora borealis will be discussed.

The reason why the maximum zone lies so far south on Prof. Fritz's chart may be sought, perhaps, in the circumstance that the climatic conditions of Iceland to a great extent reduce the number of auroræ which an ordinary observer, who only casually or on particular occasions looks at the sky, may observe. That the maximum zone of the aurora does not really fall across the part shown in the chart is also distinctly apparent from what I learnt of its appearance at the Färoe Islands during my sojourn there.

It may perhaps be superfluous to state that neither here nor in any other place have I heard the mystic auroral *sound*. Neither has it ever been heard by any of the Icelanders I have as yet met with.

Shortly before leaving Copenhagen last autumn I spoke with a celebrated Danish *savant*, who had some years ago spent some time in Reykjavik, and who told me that he had on several occasions seen auroræ descend below and in front of the mountain Esja, about 2500 feet in height, and lying six to seven English miles away (NATURE, vol. xxix. p. 337). I was delighted with the prospect of being able to see a similar phenomenon, as, although my observations in the plane Bossekop-Kautokeino, previously referred to, had greatly contributed to strengthen my belief in the height of the aurora borealis being 100 km. or more above the earth (NATURE, vol. xxix. p. 412), I would with pleasure have accepted a proof so tangible pointing in another direction. I regret to say that my expectations have not been fulfilled. This is not because the aurora has not been in close proximity to Esja, as, the mountain lying to the north-east from this place, nearly all arcs and bands rise with their eastern end up behind and run above it, but *never have I been so fortunate as to see any auroral light descend to the top of the mountain or in front of its steep sides.* Even the highest-lying clouds are also, in Iceland, *below* the plane of the aurora borealis.

In connection with this point I may further mention that the faint luminosities referred to by Prof. Lemström above the mountain-tops at Sodankylä, and in other places (NATURE, vol. xxvii. p. 322), as well as phenomena of a similar nature have, I venture to assert, never been observed here. I have continually had my attention directed to this point, and there are several mountains here, but I have never been able to trace the slightest indication of such a phenomenon.

I brought with me the necessary apparatus and appliances for effecting such experiments as Prof. Lemström pursued on some mountains in Northern Finland for the production of an artificial aurora borealis, and shortly after my arrival I came to the conclusion that the above-mentioned mountain Esja was the most advantageous for such. Its great height, steep fall into the sea, and short distance from the town, were advantages such as no other spot in the district offered, but as I only brought with me 1000 m. of insulated wire—telegraph-poles with insulators cannot be employed in consequence of the nature of the ground—and wished to conduct the wire from the top of the mountain down to the sea at its foot, I was obliged to wait until I obtained more wire by the steamer at the end of November. Since then the execution of this plan has been attempted a number of times; men, boats, and horses have been ready, and everything prepared, but every time the unfortunate weather has frustrated the same. Even in the middle of summer the Esja is a mountain difficult to ascend, and at this time of the year it would be very dangerous to undertake an ascent with the heavy wires, insulators, and poles, without the weather being remarkably quiet for several days.

I intend, however, very shortly to make another attempt, and should this fail I will select a more distant but much lower and more unfavourably situated mountain-top. I will only add that a few days after my arrival I fixed one of Prof. Lemström's "utströmnings" apparatus—with 200 points—on the flat roof of a stone tower, 30 to 40 feet in height, and which lies free and isolated on a height in the vicinity of the town; but the same has up to the present, in spite of numerous trials, given no result whatever. Any current between the points and the earth cannot be traced, and of any luminous phenomena above them there has not been the faintest appearance. SOPHUS TROMHOLT

Reykjavik, February

ON THE NATURAL AND ARTIFICIAL FERTILISATION OF HERRING OVA[1]

IN 1862 Prof. Huxley arrived at the conclusion that herring visit our shores in order to spawn twice a year, some schools arriving during the autumn, while others make their appearance during the winter. The herring which spawn during the autumn chiefly frequent banks on the east coast, while those which spawn during winter are most abundant on the west coast. A report of the Scottish Fishery Board referring to the east coast spawning beds was published in NATURE on November 29 last. The present paper deals chiefly with the Ballantrae spawning bed, which lies off the coast of Ayrshire.

In 1862 Prof. Allman made some investigations for the Scottish Fishery Board, and succeeded in dredging and hatching what was considered herring ova; but since then, although important results have been obtained by the German and American Commissioners of Fisheries, little or nothing has been done in this country.

When examining the Ballantrae Bank the author of this paper succeeded in dredging several specimens of herring ova attached

[1] Abstract of a paper read by Prof. J. Cossar Ewart, M.D., at the Royal Society, March 27. Communicated by the Author.

to stones, seaweed, and sea-firs. These stones coated with eggs varied from 6 inches to $1\frac{1}{2}$ inches in length, and from 4 inches to 1 inch in breadth, but in all cases the eggs were attached to a comparatively smooth surface, and they were arranged either in low cones or in comparatively thin layers one or two eggs deep. The eggs on the sea-firs were always attached in small clusters about half an inch in diameter around the stems. On examining the spawn found on the stones and seaweed, embryos at various stages of development were at once visible, some of them apparently only three days old, while others had distinct eyes, and from their violent movements and their size seemed almost ready for hatching. Some of the egg-coated stones were taken to the University of Edinburgh, where the eggs hatched on March 15, eight days after their removal from the spawning ground, and to-day (March 17) they are three-eighths of an inch in length, extremely active, and swimming freely about in the water.

By taking soundings over the Ballantrae Bank in various directions, it was ascertained that it consisted of rock, stones, shells, and coarse sand, and that the depths varied from 7 to 13 fathoms. The outer edge of the bank shelved at most points rapidly until a depth of 17 fathoms was reached, and at this depth the bottom consisted of fine, soft mud. While on the east coast spawning grounds examined during the autumn the surface temperature in most cases varied from 53° F. to 55° F., and the bottom temperature from 52° F. to 54° F., even at a depth of 40 fathoms, the temperature at the Ballantrae Bank varied from 42°·8 to 43°·8 F. at the surface, and from 43°·5 to 42°·8 F. at the bottom. The corresponding surface temperature, however, on the east coast during the week ending March 8 was from 2° to 3° F. lower than at Ballantrae.

According to previous observers—

"When spawning takes place naturally, the eggs fall to the bottom and attach themselves." "But at this time the assembled fish dart wildly about and the water becomes cloudy with the shed fluid of the milt. The eggs thus become fecundated as they fall, and the development of the young within the ova sticking to the bottom commences at once."

Mr. Mitchell, in his book on "The Herring," referring to the once famous spawning bed off Dunbar, states that—

"About August 30 the shoals began to deposit their spawn a short distance from the harbour, and on September 3 the fishermen found that a very large body of herrings remained fixed to the ground in the progress of spawning, the ground being of a rocky or stony nature."

While many fishermen believe that herring spawn on hard ground, some believe that they also spawn on a clayey bottom; and while some think they spawn near the bottom, others affirm that they spawn near the surface. Having secured at Ballantrae a large number of live herring, some of the largest and ripest males and females were placed in a large wooden tank into which a number of stones and a quantity of seaweed had been previously introduced. After the fish had been about two hours in this tank, the stones and seaweed were examined. Although a few eggs were attached to both stones and seaweed, it was quite evident that the eggs had not been deposited in the same way as those found on the stones dredged on the previous day; but we were not surprised that only a few isolated eggs were found on the stones, because the fish had been disturbed every few minutes by the pouring of water into the tank.

On reaching Rothesay the hatching boxes and live herring were at once transferred from H.M.S. *Jackal* to the tanks—a tank into which comparatively little light entered being selected for the ripest and most vigorous herring. In about half an hour after they were introduced a large full herring was seen moving slowly about the bottom of the tank with four other fish making circles around her at some distance from the bottom. Appearing satisfied with a particular stone which she had evidently been examining, she halted over it and remained stationary for a few minutes about half an inch from its surface, the tail being in a straight line with the tank and the pectoral fins near or resting on the bottom.

While in this position a thin, beaded ribbon was seen to escape from the genital opening and fall in graceful curves on the surface of the stone, so as to form a slightly conical mass almost identical with a cluster on one of the stones dredged at Ballantrae. As this little heap of eggs increased—some falling to the left side one moment, while others fell to the right the next, according to the currents in the water—the males continued circling round her at various distances, while the other females in the tank remained apart. The males remained from 8 to 10 inches above the bottom of the tank, and formed circles varying from 18 inches to 2 feet 6 inches in diameter. Some of the males were swimming from right to left, others from left to right; and although there was no darting about, no struggling amongst themselves, there was a peculiar jerking of the tail as they performed their revolutions. Soon the object of this peculiar movement was sufficiently evident. Three or four times during each revolution each fish expelled a small white ribbon of milt, which varied from half an inch to three-quarters of an inch in length, and was nearly a line in breadth across the centre, but pointed at both ends, and somewhat thinner than it was broad. These delicate ribbons slowly fell through the water, sometimes reaching the bottom almost undiminished in size, but in most instances they had almost completely dispersed before the bottom was reached. In this way the whole of the water about the female became of a very faint milky colour, and practically every drop of it was charged with sperms, as was afterwards ascertained. It will thus be seen that there is no attempt whatever on the part of the males to fertilise the eggs as they escape from the female. While the female is depositing the eggs at the bottom, the males concern themselves with fertilising the water in the neighbourhood, and it will be observed that the males are careful to guard against the influence of currents by forming circles around the female and shedding milt on the way. It matters little how the currents are running, they are bound to carry some of the milt towards the eggs, the milt, like the eggs, sinking though not adhering to the bottom.

This then is the natural process of depositing and fertilising the ova of the herring in comparatively still water. When the female had deposited a certain number of eggs at any given spot, she moved forward in a somewhat jerky fashion without rising from the bottom, and as she changed her position the males changed theirs, so that the female was always surrounded by a fine rain of short sperm ribbons. A specimen of *Hydrallmannia* sent from Eyemouth seems to indicate that the female moves about amongst sea-firs and seaweeds in exactly the same way as she does amongst stones. On each stem of the colony there is a cluster of ova about the size of a small grape, and all the clusters had reached on arrival the same stage of development as if they had been deposited about the same time and by the same fish.

This method of depositing and fertilising the eggs accounts, I think, for all the eggs, or at least for a very large percentage of those found attached to sea-firs, seaweeds, and stones, containing developing embryos.

When a female was depositing her eggs, she was very easily disturbed; whenever anything was introduced into the tank she at once darted off. When strong currents were made, she at first seemed to apply herself nearer to the bottom, to make sure, as it were, that the spawn would get fixed before it could be carried away; but when the currents were further intensified she at once changed her position, and arrested the escape of the spawn. A spawning female was held immediately under the surface of the water so as to cause the spawn to escape. When this was done the spawn escaped in long ribbons consisting of a single row of eggs. So firmly do the eggs adhere to each other that in perfectly still water the ribbon was sometimes over a foot in length before it broke. When it had only about two feet of water to travel through, it fell in wide loops at the bottom, but when it had to fall over three feet the chain broke up into numerous segments which formed an irregular pattern on the bottom. From experiments made, it seems the further the eggs have to fall and the longer they are in contact with the water before they reach the bottom, they are more widely dispersed, and have all the less adhesive power. When the eggs are expressed in water moving rapidly in various directions, the chains soon break into short segments, and the individual eggs and the small groups are often carried a considerable distance before they reach the bottom.

A number of flat stones and pieces of seaweed were obtained, and a spawning female held over them at different distances in still water, in water with gentle currents, and in water with strong currents. In this way we obtained groups of eggs which mimicked in a very striking manner all the arrangements of the eggs on the stones and seaweeds dredged on the Ballantrae Bank. When gently pressed, a beaded ribbon consisting of a single row of eggs always escaped; when there were no currents, it formed a conical heap; when in a gentle current, the ribbon fell in irregular loops, the elements of which rearranged themselves so as to form a flattened cone; but when strong currents acted on it the ribbon was broken into fragments and only a few eggs succeeded in fixing themselves to the objects introduced. When the currents were strong, the males were seen not only to swim nearer the bottom but to expel longer ribbons of milt, which reached the bottom before getting dispersed and remained visible sometimes for ten minutes. On gently expressing a male under the water it was never possible to expel so fine or so short portions of milt as escaped naturally, but it was extremely easy expelling a ribbon from 18 inches to 3 feet in length, measuring 2 lines across and 1 line in thickness. Such ribbons fell to the bottom and remained almost unchanged for nearly two hours; they then assumed a segmented appearance, and in about three hours and a half had all but disappeared.

Eggs were allowed to escape into a vessel containing fine sand, and into another containing mud. The eggs after being fertilised underwent the early stages of development, but either owing to their moving freely about with the sand particles or owing to their getting coated over with the sand and mud their development was arrested. I have not yet determined finally if the development is arrested when the eggs are detached while development is proceeding, but this seems extremely probable.

When at Ballantrae I noticed that the trammel nets secured often more males than females. Mr. Wilson, fishery officer at Girvan, informs me that the ripest fish are caught in the trammel nets, while most of the unripe fish are obtained in the drift nets, and that at the end of the fishing season there are about three males taken for every two females, indicating not necessarily that the males are more abundant than the females, but rather that the males remain longer on the spawning ground; and Mr. Wilson believes that herring prefer quiet water free from strong currents when spawning, and that when the weather is fine the herring remain long upon the bank and deposit their spawn leisurely, but when there are strong currents they either hurry the spawning process or disappear into deep water.

As to artificial fertilisation and hatching I found, after many experiments at Ballantrae, that the best results were obtained when both the male and female were held under water while the milt and ova escaped, *i.e.* when the natural process of spawning is followed.

An ordinary wooden tub was obtained and filled with seawater. Into this a small quantity of milt was expressed, the male being held completely under water while the milt escaped. A glass plate was then held about four inches beneath the surface of the water, and, the female herring being held about one inch beneath the surface, by gentle pressure the eggs readily escaped in the characteristic narrow beaded ribbon, and, by moving the fish over the surface of the glass, either a close or an open network could be formed. At first, where one loop crossed another, the eggs were two or more layers thick, but, either owing to the weight of the eggs or the gentle currents set up in the water, before a few minutes had elapsed, the eggs formed a single and almost continuous layer, the network arrangement having disappeared. The plate was then allowed to rest for two or three minutes at the bottom of the tub, and a few short ribbons of milt were again introduced. After moving the plate once or twice across the top of the tub in order to wash off any scales that were adhering, it was placed either in a hatching or a carrying box. Many thousands of ova treated in this way contain extremely active embryos, which are expected to hatch on March 22 or 23.

Prof. Ewart exhibited a number of specimens showing herring eggs attached to stones, seaweeds, and sea-firs, and some of the herring fry hatched on March 24 from the eggs artificially fertilised on March 8.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

OXFORD.—The electors have awarded the Radcliffe Travelling Fellowship after examination to Mr. J. E. Blomfield, B.A., late Natural Science Demy of Magdalen College, and now of University College Hospital, London. The Fellowship is of the annual value of 200*l.*, and tenable for three years provided that the Fellow travels abroad for his improvement in the study of medicine. This is the fourth time in the last five years that this prize Fellowship has been won by a student of Magdalen College.

CAMBRIDGE.—From the report of the last Local Examinations it appears that the answers in pure mathematics exhibited considerable improvement, while in applied mathematics the work was inferior, and much of the teaching in statics was imperfect, and not based on mathematics. In chemistry great inequality was shown, some centres sending uniformly good work, others being very inferior. The practical work is better done than the theoretical. The teaching of experimental physics is still very ineffectual in its results. In the senior paper in electricity and magnetism only two of the candidates showed any proof of accurate knowledge or scientific training.

In biology the answers were, on the whole, not good, yet at some centres candidates did extremely well. In botany vegetable physiology showed improvement, but floral diagrams are not sufficiently used. In zoology the candidates seemed to have no idea of the relative value of facts. In physical geography a marked absence of scientific method was noticeable in the answers; great ignorance of meteorological terms used in most daily papers was manifested.

The Cambridge Local Lectures have made good progress in the past session, much good having resulted from the conference of local committees and lecturers held last year. In a number of centres local associations have been formed for putting the lectures on a permanent basis. At Derby an Artisans' Higher Education Society has been formed, the subscription being very low. At the Midland Railway works the large mess-rooms have been utilised in giving short lectures to arouse interest among the men, Prof. Teall lecturing on chalk, Mr. Bemrose on the transit of Venus, Mr. Heycock on digestion, respiration, &c., and the men have always been appreciative. In the Newcastle district much eagerness has been shown by pitmen to attend the lectures, often at great personal cost and inconvenience. The cost, indeed, is so great as to form an obstacle of serious magnitude, and it is found that the desire for lectures is such that the overcoming of financial difficulties would lead to an enormous extension of the work. Efforts are being made to get the rules of the Trades Unions altered so as to enable them to contribute towards the cost of the lectures.

It is now proposed to constitute an examination in French or in German as the additional subjects required of candidates for honours degrees, unless the candidates choose rather to pass the General Examination for the B.A. degree. This change would be welcomed by the large number of students to whom the study of works in French and German would be an important aid in their Tripos subjects.

SCIENTIFIC SERIALS

THE *Journal of Botany* for March contains the conclusion of Mr. T. Hick's valuable paper on protoplasmic continuity in the Florideæ. In quite a number of distinct genera belonging to this class he has now traced connecting threads between the protoplasm from cell to cell. He regards these threads as permanent and essential structures, normally present in all parts of the thallus from the oldest to the youngest, not restricted to special localities and special cells.—Some details of the life-history of a rare and little-known British plant, *Lithospermum purpureo-cœruleum*, are contributed by Mr. Jas. W. White.

American Journal of Science, March.—Experimental determination of wave-lengths in the invisible prismatic spectrum, with plate, by S. P. Langley.—The Quaternary gravels of Northern Delaware and Eastern Maryland, with map, by Frederick D. Chester. From a careful survey of this region the author infers that the peninsula became depressed at least 350 feet towards the close of the Glacial period, when the estuary thus formed received the discharge of the Delaware River, which pushed its way across the present States of Delaware and Maryland to the head of the Chesapeake. By this current and the subsequent distributing action of the waves the red gravel was deposited. Later on the land began to rise, the violence of the flood was abated, and the northern glacier gradually broke up. During this period the Philadelphia Clay was deposited, and the boulders distributed over the estuary by the icebergs from the glacier. The land continuing to rise, the shoal gravels were piled up by the waves and tides, the river began to assume its present channel, and the Delaware and Chesapeake were finally parted.—On the identity of scovillite with rhabdophane, by G. J. Brush and S. L. Penfield.—A theory of the recent sun-glows, by H. A. Hazen. The author attributes the phenomena to the presence of watery vapour, ice crystals, or frozen water particles under a peculiar form in a rarefied atmosphere at a low temperature.—On the topaz and associated minerals found at Stoneham, Maine, by George F. Kunz.—A contribution to the study of the geology of Rhode Island, with map, by T. Nelson Dale.—On the crystalline form of the supposed herderite from Stoneham, Maine, by Edward S. Dana.

SOCIETIES AND ACADEMIES

LONDON

Chemical Society, March 20.—Dr. W. H. Perkin, president, in the chair.—The following gentlemen were elected Fellows:—F. W. Brown, H. Cave, F. W. Fleming, E. E. Graves, A. E. Lewis, J. E. London, G. A. Parkinson, S. Smith, G. Tunbridge, T. U. Walton.—The following papers were read:—Note on the preparation of marsh gas, by Dr. J. H. Gladstone and Mr. A. Tribe. In 1873 (*Chem. Soc. Journ.* xi. 682) the authors described a reaction in which pure marsh gas was obtained by the action of the copper-zinc couple on methyl iodide in the presence of alcohol. The loss of the methyl iodide was considerable, 23 to 50 per cent. In the present note the authors describe a slight modification by which this loss can be prevented. It consists essentially in passing the gas evolved through a vertical tube twelve inches long filled with the copper-zinc couple.—On the action of dibrom-α-naphthol upon amines, by R. Meldola. The author has investigated the action of dibrom-α-napthol upon anilin, orthotoluidin, paratoluidin, and α-naphthylamin. With anilin a body was obtained which proved to be β-naphthoquinonedianilide; similar bodies were obtained with toluidin, &c. This reaction therefore furnishes a simple method of obtaining these quinoneimides in large quantities. The author also discusses the bearing of this reaction on the constitution of these bodies.—Note on the existence of salicylic acid in the cultivated varieties of pansy and in the Violaceæ generally, by A. B. Griffiths and E. C. Conrad. The authors state that they have extracted salicylic acid from the leaves, stems, and roots of the pansy; apparently none exists in the flowers.

Zoological Society, March 18.—Prof. W. H. Flower, F.R.S., president, in the chair.—Mr. Tegetmeier exhibited specimens showing a variation in the colour of the feet of the pink-footed goose (*Anser brachyrhynchus*).—A communication was read from Sir Richard Owen, K.C.B., on the extinct birds of the genus *Dinornis*, forming the twenty-fifth of his series of memoirs on the subject. The present paper gave a description of the sternum of *Dinornis elephantopus*.—Mr. J. B. Sutton, F.Z.S., read an account of the results of his investigations of the more important diseases which affect the carnivorous animals living in the Society's Gardens.—Mr. J. W. Clark, F.Z.S., exhibited and read an account of three skulls of a sea-lion from the east coast of Australia. The largest, that of an adult male, had been exhibited, together with the stuffed skin, at the Fisheries Exhibition last year, where it had been named *Arctocephalus cinereus*, Gray. The object of the paper was to trace the history of the species for which the name *Otaria cinerea* had been suggested by Péron in 1816, and to show, by comparison with the type skull at Paris, that these specimens had been rightly referred to.—A communication was read from the Rev. O. P. Cambridge, in which he gave descriptions of two new genera of spiders proposed to be called *Forbesia* and *Regillus*.

Physical Society, March 22.—Prof. Guthrie, president, in the chair.—The President announced that a meeting of the Society would be held on May 10 at Birmingham, by invitation. The next meeting will be on April 26.—Prof. S. P. Thompson then read a paper by himself and Mr. C. Starling on Hall's phenomenon. The authors had not agreed with Hall's explanation of his observed effect, and last year undertook experiments to investigate its nature. They employed a strip of tinfoil gummed on a mahogany board with vaseline, which, being soft and a non-conductor, answers well for this purpose. A top-shaped electromagnet with a pointed pole was used on one side of the strip to try the effect of a pointed pole. The current was obtained from accumulators. They found that the equipotential lines in the strip, which before magnetisation ran straight across the strip, were slightly curved on either side of the pointed pole after magnetisation. This curving was interpreted as a reduction of resistance in the strip at the pole, and subsequent tests of the resistance of the strips in a magnetic field confirmed this view. Iron strips, however, showed a slight *increase* of resistance. It was also found that an effect similar to Hall's was got by placing the pointed pole so that this change of resistance was not symmetrical with respect to the points in the strip to which the galvanometer was connected. But inasmuch as the effect was not reversible by reversing the magnetism, it was not Hall's effect, which they failed to obtain with the narrow pointed pole. In their experiments thermo-electric effects were eliminated, and their results, though different, do not clash with those of Mr. Bidwell.—A paper by Mr. Herbert Tomlinson on the same subject was read by Prof. Reinold. The author drew attention to a similarity between Hall's table of results and one of his on the effects of mechanical stress on electrical resistance.—Mr. Shelford Bidwell read a note on Hall's effect in tin, in which he showed that a small extension and a greater extension produced opposite thermo-electric effects in tin wires.—In answer to Prof. Guthrie and Mr. Walter Baily, Prof. Thompson stated that the change of resistance he had observed was sub-permanent, and died away in about half an hour. He believed it to be producible on the strip when no current traversed it.—Prof. S. P. Thompson then read a paper on some propositions in electromagnetics, giving a connected series of explanations throwing light on the laws of electromagnetics, and based on a practical experiment.

Royal Microscopical Society, March 12.—Rev. H. W. Dallinger, F.R.S., president, in the chair.—Mr. Glaisher introduced Mr. Dallinger to the meeting on taking his seat for the first time as president, and the latter made a short address in acknowledgment.—Mr. J. Mayall, jun., described the improved Nelson-Mayall lamp, in which the burner could be brought down very close to the table; also Boecker's improved freezing microtome.—Mr. Crisp exhibited Schieck's microscope with fine adjustment made by tilting the stage at one end; also Watson's rotating stage, Collin's set of fish-scales, and a slide of a hydroid polyp with extended tentacles, mounted by Mr. E. Ward.—Notes were read: On a multiple eye-piece by Mr. E. H. Griffith, in which eye-lenses of different powers were mounted on a rotating disk; by Col. O'Hara on some peculiarities in the form of blood-corpuscles; and a communication from a Microscopical Society recently formed at San Francisco, and consisting of ladies.—A paper was read by Mr. T. B. Rosseter describing some peculiar annular muscles in *Stephanoceros*; also by Prof. Reinsch, who stated that he had found bacteria and non-cellular Algæ to exist in considerable numbers on almost all copper and silver coins which had been for some time in currency; also by Mr. G. Massee on the formation and growth of cells in the genus *Polysiphonia*, being a further contribution to the evidence on the continuity of protoplasm through the walls of vegetable cells; also by Prof. Abbe on the distance of distinct vision, in which he pointed out the erroneous inferences which had arisen from the practice of expressing the amplifying power of a lens by reference to a fixed distance of vision (10 inches, or 250 mm.).—Some new forms of cells devised by Mr. Wilks and made by Mr. E. Ward for mounting without pressure in balsam were also exhibited and described.

Royal Meteorological Society, March 19.—Mr. R. H. Scott, F.R.S., president, in the chair.—Messrs. W. Baily, M.A., W. L. Blore, A. L. Ford, H. Leupold, A. F. Lindemann, F.R.A.S., and Rev. E. B. Smith were elected Fellows of the Society.—The President read a paper entitled brief notes on the history of thermometers. He stated that the subject had been handled in a comprehensive manner by M. Renou a few years ago in the *Annuaire* of the French Meteorological Society, so that he should merely mention some of the leading points. The name of the actual inventor of the instrument is unknown. The earliest mention of it, as an instrument then fifty years old, was in a work by Dr. R. Fludd, published in 1638. Bacon, who died in 1636, also mentions it. The earliest thermometers were really sympiezometers, as the end of the tube was open and plunged into water, which rose or fell in the tube as the air in the bulb was expanded or contracted. Such instruments were of course affected by pressure as well as temperature, as Pascal soon discovered. However, simultaneously with such instruments, thermometers with closed tubes had been made at Florence, and some of these old instruments were shown at the Loan Collection of Scientific Apparatus at South Kensington in 1876. They are in the collection of the Florentine Academy, and in general principle of construction they are identical with modern thermometers. Passing on to the instrument as we now have it, Mr. Scott said that most of the improvements in construction in the earliest days of the instrument were due to

Englishmen. Robert Hooke suggested the use of the freezing point, Halley the use of the boiling point, and the employment of mercury instead of spirit, and Newton was the first to mention blood heat. Fahrenheit was a German by birth, but was a *protégé* of James I., and died in England. Réaumur's thermometer in its final form owes its origin to De Luc, while the centigrade thermometer, almost universally attributed to Celsius, was really invented by Linnæus. Celsius's instrument had its scale the reverse way, the boiling point being 0°, and the freezing point 100°. Mr. Scott then gave a brief account of some of the principal forms of self-registering and self-recording thermometers.—After the reading of this paper the meeting was adjourned, in order to afford the Fellows and their friends an opportunity of inspecting the exhibition of thermometers and of instruments recently invented. This exhibition was a most interesting one, and embraced 136 exhibits. The thermometers were classified as follows: (1) standard, (2) maximum, (3) minimum, (4) combined maximum and minimum, (5) metallic, (6) self-recording, (7) solar radiation, (8) sea, (9) earth and well, (10) thermometers used for special purposes, (11) thermometers with various forms of bulbs, scales, &c., and (12) miscellaneous thermometers. In addition to these there were also exhibited various patterns of thermometer screens, as well as several new meteorological instruments, together with drawings, photographs, &c.

Anthropological Institute, February 26.—Edward B. Tylor, Esq., F.R.S., vice-president, in the chair.—It was announced that Dr. Walter H. C. Coffin, Dr. Emil Riebeck, Miss H. M. Hargreaves, and Miss Helen E. Pearson had been elected Members of the Institute.—The Rev. R. H. Codrington read a paper on the Melanesian languages. In the term Melanesia the author included (1) New Caledonia, with the Loyalty Islands; (2) the New Hebrides; (3) the Banks' and Torres' Islands; (4) Fiji; (5) Santa Cruz and the Reef Islands; (6) the Solomon Islands. The object of the paper was to set forth the view that the various tongues of Melanesia belong to one common stock, and that this stock is the same as that to which the other Ocean languages belong—Malayan, Polynesian, the languages of the islands that connect Melanesia with the Indian Archipelago, and Malagasy.—A paper by the Rev. Lorimer Fison, on the "Nanga," or sacred stone inclosure of Wainimala, Fiji, was read by Dr. Tylor. The author explained the constitution of the Nanga, and described the ceremony of initiation and other rites connected with it.

March 11.—Prof. Flower, F.R.S., president, in the chair.—The election of W. Ayshford Sanford was announced.—Mr. A. L. Lewis read a paper on the Longstone and other prehistoric remains in the Isle of Wight.—Mr. W. J. Knowles read a paper on the antiquity of man in Ireland. The author exhibited a series of flints discovered by him at Larne and other parts of the north-east coast of Ireland, some of which he believed to have been dressed in imitation of certain pear-shaped nodules or hammer-stones found at the same spot, while others showed more evident signs of human workmanship. One large chipped implement was found in what appeared to be true, undisturbed boulder-clay, and hence the author contended that the implements he exhibited were not only older than the Neolithic Age in Ireland, but older even than those previously known as Palæolithic, and that they carry the age of man back into the Glacial period.—A paper by Admiral F. S. Tremlett on the Cromlec of Er Lanic was read.—A paper by Mr. Henry Prigg on a portion of a human skull of supposed Palæolithic age from near Bury St. Edmunds was read. The author exhibited the fragment, which consisted of portions of the frontal and right and left parietal bones, and also two flint implements found in the same locality.

DUBLIN

Royal Society, February 18.—Section of Physical and Experimental Science.—G. Johnstone Stoney, F.R.S., in the chair.—On Mr. J. J. Thomson's theory of electricity, by Prof. G. F. Fitzgerald, F.R.S. After explaining Mr. Thomson's theory, Prof. Fitzgerald pointed out that it seems very unlikely that electrified bodies *in vacuo* would not attract or repel one another, inasmuch as experiments seemed to show that the only effect of matter between electrified bodies was to alter the specific inductive capacity of the space, and so Mr. Thomson's theory was more probable as an explanation of how gases had a specific inductive capacity different from unity. In a communication on the mechanical theory of Crookes' force made to the Society in 1878 he had shown that a polarisation of the motions of the molecules in a gas of a particular kind would produce the same stresses as are required to explain electrostatic actions. He explained how a suitable polarisation of the motions or positions of the superficial molecules of a conductor, due to their being on the surface of separation of a constant and variable electric potential, was probably the cause of electrostatic attractions. He pointed out that the ordinary hypothesis that molecules act on one another by means of the ether, and so transmit mechanical stress across intermolecular layers of ether was an assumption of precisely the same kind at intermolecular distances as Maxwell's theory of electricity was at molar distances, and expected that a suitable strain of the superficial molecules of a body would transmit a stress through the ether. Prof. Fitzgerald explained a particular hypothesis as to the nature of this polarisation of the superficial molecules on the vortex theory of atoms, which, however, seemed subject to the very serious objection that it appeared at first sight as if two oppositely electrified planes would tend to move bodily in one direction. The hypothesis was founded on the fact that when two vortex rings are going in the same direction, and one following the other, they attract; but if going in opposite directions they repel one another. The polarisation supposed was that an electrified surface had the superficial molecules all turned in one way, preferably negatively electrified bodies with the faces of the vortex atoms outwards, and positively electrified bodies with their backs outwards. He described how contact-electricity, thermo-electricity, and electro-chemical actions might be explained on this hypothesis. This hypothesis was put forward more as an illustration of how a polarisation of the superficial molecules of a body might produce attractions and repulsions than as an hypothesis that really explained electrostatic actions.—On Prof. Osborne Reynolds's mechanical illustrations of heat engines, by Prof. G. F. Fitzgerald, F.R.S. After explaining Prof. Osborne Reynolds's beautiful illustrations, he described three arrangements, one by setting a chain rotating in loops and nodes, one by a balanced centrifugal pendulum, and the third by a pair of masses running on a revolving radius, by means of which all the operations in Carnot's cycle might be illustrated, and explained how to arrange that temperature should be represented by the angular velocity of the rotating masses, and how by means of a chain passing over a pulley in the second case, and by a chain drawn off a table in the third case, it was easy to arrange that the masses should expand when given energy at a constant velocity. He explained how an arrangement in which the masses when not rotating would rest in any position represented an ideal gas in which no internal work is spent in expansion. Prof. Fitzgerald described how by means of a dynamo driven from a battery, a self-acting engine of this kind could be arranged which would show when it was absorbing and when giving out energy. He explained that it was easier to work these models when promiscuous agitation was represented by rotatory motion than when it was really promiscuous, and that it was for this reason rotatory motion was adopted. Mr. Stoney, in some remarks he made on this communication, explained how necessary it was that the energy be really promiscuous, in order that it be subject to the second law of thermodynamics, showing how it would be possible to get a region in which all the radiant energy was plane polarised to radiate into a hotter similarly polarised region without allowing the latter to lose any heat by radiating any of its original energy. He proposed to do this by means of a plate of quartz that rotated through 90° the plane of polarisation of the radiant energy that passed through it, and by a doubly refracting prism, thus admitting heat energy into the second region that was polarised at right angles to that originally there, while the polarised radiant energy that escaped back again was returned into the region it came from, being bent out of the path of the entering energy by the doubly refracting prism.—Prof. Fitzgerald exhibited a lecture balance. In this arrangement a beam of light fell parallel to the axis of the balance on a mirror attached at 45° to this axis, so that the reflected ray turns through the same angle as the balance. The balance was provided with an arrangement by which its stability could be altered very much, so as to be suitable for either rough or delicate weighing. As the difference of weights in the pans of a balance is proportional to the tangent of the angle of deflection, a vertical scale uniformly divided showed by the position of the spot of light the difference of the weights in the pans in a manner that could be easily read by a large class.

Section of Natural Science.—V. Ball, F.R.S., in the chair.—Gerrard A. Kinahan read a paper entitled "Notes on the Coal-fields of the North-West Territories of Canada."

CAMBRIDGE

Philosophical Society, March 10.—Mr. D'Arcy W. Thompson, B.A., Trinity College, was elected a Fellow.—The following papers were communicated:—Continuation of observations on the state of an eye affected with astigmatism, by Sir G. B. Airy. The paper consisted of a continuation of observations already recorded in the publication of the Society. The author gave tables of the distances from the cornea of the left eye at which a luminous point appears respectively as a horizontal and a vertical straight line. The observations have extended from the year 1825 to the present time.—On the measurement of the electrical resistance between two neighbouring points on a conductor, by Lord Rayleigh. In some experiments described in a recent paper read before the Royal Society, the author had occasion to arrange a set of resistance coils so that the difference of potential between two points on a circuit through which a current is flowing shall be exceedingly small and yet known to a high degree of accuracy. In the present communication the method is applied to determining the difference of potential between two neighbouring points on a conductor through which the same current is flowing. The resistance coils are adjusted until the difference of potential measured by the current produced in a galvanometer of comparatively high resistance is the same in the two cases. The method has been applied by Messrs. Ward and Shackle at the Cavendish Laboratory to determine the value of a small resistance of about 1/200 of a B.A. unit, and is capable of very great accuracy.—On dimensional equations and change of units, by Mr. W. N. Shaw.

SYDNEY

Linnean Society of New South Wales, January 30.—C. S. Wilkinson, F.G.S., president, in the chair.—The President delivered an address on the progress of science in Australia during the past year, and concluded by a general account of the geology of the country from an economic point of view.—The following papers were read:—Supplement to the Descriptive Catalogue of the Fishes of Australia, by William Macleay, F.L.S., &c. This paper contains references to, or descriptions of, 157 species of fishes not mentioned as Australian in the previously printed catalogue. The species here described for the first time are from the pens of Dr. Klunzinger, Dr. Günther, Messrs. De Vis, Ramsay, Macleay, and R. M. Johnston. The total number of Australian fishes now amounts to 1291 species.—On some new Batrachians from Queensland, by Charles W. De Vis, M.A. This paper contains descriptions of three new species of frogs, collected at Mackay, by Mr. H. Ling Roth, and named by the author as follows:—*Limnodynastes lineatus*, approaching *L. peronii*, but distinguished by shorter hind limbs, and continuity of dorsal stripes; *L. olivaceus*, and *Hyla rothii*.—On plants indigenous in the immediate neighbourhood of Sydney, by Mr. Haviland. This, the sixth of the series, gives an account of some species of the genus *Darwinia*, showing the supposed manner of fertilisation, and explaining, to some extent, the prevalence of the species *D. fascicularis*, notwithstanding the great disproportion between the fertilised and the fertilising flowers.—Studies on the Elasmobranch skeleton, by William A. Haswell, M.A., B.Sc.

PARIS

Academy of Sciences, March 24.—M. Rolland in the chair.—Influence of the density of explosive gaseous mixtures on pressure; isomerous mixtures, by MM. Berthelot and Vieille.—Separation of gallium from boric acid, by M. Lecoq de Boisbaudran. This concludes the series of exhaustive experiments conducted by the author for the purpose of obtaining the complete separation of gallium from all other known elements. A final communication is promised on the separation of gallium from tartaric acid, taken as a type of organic substances whose presence might affect several of the reactions indicated during the course of the foregoing studies.—On the concordance of some general practical methods, based on apparently opposite principles, for determining the tensions in a system of points connected by electric links and kept in equilibrium under the action of external forces, by General L. F. Menabrea.—Observations of Saturn and Uranus made at the Observatory of Nice, by M. Perrotin. These observations were made under unusually favourable conditions by Messrs. Norman Lockyer, Thollon, and Perrotin on March 16 and 18. The outer ring of Saturn appeared to consist of three distinct rings slightly diminishing in breadth outwardly, and each apparently made up of numerous subdivisions. Uranus, seen on the 18th, presented in some respects the general aspect of Mars, with dark spots towards the centre, and a white speck like the pole of that planet at the angle of position 380° on the edge of the disk. Mr. Lockyer, who was present at the sitting, read a telegram from M. Perrotin announcing a repetition of the observations on March 23 under equally favourable conditions.—Note on the polar spots in Venus, observed at the Meudon Observatory, by M. E. L. Trouvelot. These spots seem to be permanent, although varying greatly in brilliancy, and often rendered invisible by the distance of the planet towards superior conjunction.—On the thrust of a mass of sand with horizontal upper surface against a vertical wall, in the neighbourhood of which its inner angle of friction is assumed to be slightly increased according to a definite law, by M. J. Boussinesq.—On the extension of the theorems of Pascal and Brianchon to surfaces of the second order, by M. A. Petot.—On a probable cause of the discrepancies found to exist between the electromotor force of voltaic piles and the theoretical results of thermochemical observations, by M. G. Chaperon.—Note on the action exercised by polarised light on cellulose solutions in Schweizer's fluid, by M. A. Levallois.—Remarks on a case of dimorphism observed with the hyposulphite of soda ($NaO,S_2O_2,5HO$), by MM. F. Parmentier and L. Amat.—Researches on the sulphites and bisulphites of soda, by M. de Forcrand.—On the dissymmetric chloro-iodurетted and bromo-iodurетted ethylenes, by M. L. Henry.—Experimental researches on the influence of extremely high pressure on living organisms, by M. P. Regnard. These experiments were conducted by means of the press of MM. Cailletet and Ducretet, yielding pressures of 1000 atmospheres and upwards. Soluble ferments were unaffected by extreme pressure; starch at 1000 was changed to sugar; algæ at 600 were decomposed, and the carbonic acid liberated; infusoria, leeches, and mollusks at 600 were rendered insensible, but recovered when the pressure was removed; fishes with swimming bladder resisted 100, became insensible at 200, and succumbed at 300. These results show interesting coincidences with the phenomena observed by the naturalists of the *Talisman* at various oceanic depths.—On the action of cold on microbes, by MM. R. Pictet and E. Yung. Many inferior organisms resisted temperatures of from $-70°$ to $-130°$ C. for several hours. Others were either killed or lost their germinating functions.—On peritoneal transfusion, by M. G. Hayem.—On the medullar mechanism of paralyses of cerebral origin, by M. Couty.—Anatomical description of the fœtus of a gorilla recently brought from the Gaboon, by M. J. Deniker.—On the anatomy of the *Peachia hastata* discovered by Gosse in 1855, by M. Faurot.—On the structure of the auditory organ in *Arenicola grubii*, Clap., by M. Et. Jourdan.—Anatomy of the muscles in the abdomen of the bee, by M. G. Carlet.—Note on a deposit of gold at Peñaflor in Andalusia, by M. A. F. Noguès.—On certain changes in the appearance of the sky recently observed at Nice, by M. L. Thollon.—On the crepuscular glows observed at San Salvador, in Central America, by M. de Montessus.

BERLIN

Physiological Society, February 29.—Dr. Weyl spoke about the secretion in man of nitric acid, which he had analytically proved, and which, by administration of ammonia, he was able quantitatively to increase. After it had been experimentally established that a direct transference of albumen into urine was impossible, it was recognised that the formation of urine was no oxidising process of the albumen, but was effected circuitously by the formation of amido-compounds, whose introduction into the animal body increased the quantity of the secreted urine. The formation of urine took place through alimentation of the simplest amidinous matters, ammonia increased the secretion of urea. Similar to the action of ammonia was that of a carbonate of ammonia, as also when combined with organic acids, while from hydrochlorate, sulphate, and mineral acid salt, the ammonia did not become transformed into urea. On perusing the literature of the subject, Dr. Weyl found that in all experiments the ammonia was never wholly transformed into urea, but that there was always a residue of from 10 to 40 per cent. which was not represented in the urine. This residue of ammonia, he conjectured, was consumed in the animal body, and he therefore made search in animals to which he had given ammonia, for the presence of nitric acid. Rabbits not being adapted for precise experiments in connection with the transmutation of matter, he experimented on dogs, but always failed to discover any nitric acid in their urine. Even when he had given these animals nitrates, no nitrates could be found in their urine. He now tried experiments on men, and soon ascertained that in their case nitric acid was a perfectly normal product of secretion. The quantitative determinations, even where no nitrate was administered, yielded from 400 to 600 mgr. of nitric acid in the contents of the urine. The quantity of nitric acid varied with the nourishment, and by the use of vegetables could be considerably increased. To test the accuracy of his conjecture regarding the fate of the ammonia not converted into urea, he took with a uniform regulated diet citrated ammonia in doses of from six to eight grammes, and found in two series of experiments a very marked increase of the nitric acid in the urine—in one case, for example, of from about 500 to over 800 mgr. This constant presence in no inconsiderable quantities of nitric acid in the urine of man ought, in experiments connected with the change of matter, to be carefully attended to. Historically, Dr. Weyl observed that more than thirty years ago Bence Jones had made the assertion that in the animal body ammonia was oxidised into nitric acid. He was, however, unable to substantiate this proposition without raising objections.—Prof. Kronecker reported on the discovery of a coordination centre in the movements of the ventricles of the heart, made by Herr Schmey, a student in his department of the Physiological Institute, and which he (Prof. Kronecker) had repeatedly verified. In an examination of the changes in the dimensions of the heart in the process of contraction, needles were thrust in the most various directions into the heart of a dog after it had been laid bare, an operation which, as was known by experience, had no influence on the movements of the heart. When in this operation the needle came upon a certain small spot on the lower border of the upper third of the *septum cordis*, the ventricles of the heart at once ceased to beat, and, diastolically dilated, fell into fibrillar convulsions, which were soon followed by the death of the ventricles of the heart. It was not possible by any appliances to restore the ventricles to their normal action. The vestibules continued to beat normally, but the ventricles no longer discharged their blood, and soon, in consequence of the palsy of the heart, general death set in. This instantaneous death of the heart through a prick in a particular part of the septum—the stoppage thereby produced of each coordinate contraction of the muscles of the heart—was up to the present wholly without analogy. What approached nearest to this fact was the well-known phenomenon that a compression of the coronary artery produced in a short time a cessation of pulsation and fibrillar convulsions. On withdrawing the compression, however, the pulsations of the ventricle were resumed. In the case of a prick, on the other hand, the effect followed altogether much more quickly, quite instantaneously in fact, and the ventricles, not able again to discharge their functions normally, were for ever motionless. This phenomenon Prof. Kronecker explained in the following manner. By the prick of the needle a coordinating centre in the movements of the ventricles of the heart, having its seat at the spot in question in the septum, was touched and destroyed. The finding of this centre afforded the physiological key to the riddle not unknown in surgery, that many very slight heart-wounds, pricks of needles, for example, which did not even penetrate, produced sudden death. It was now the task of anatomical investigation to demonstrate the existence of this centre now experimentally proved to exist. Prof. Kronecker and Herr Schmey have demonstrated this important experiment to the satisfaction of the Society.

VIENNA

Imperial Academy of Sciences, January 17.—M. Tüllig, on a new mode of telephonic transmission of sound (sealed packet).—J. Kachler and F. V. Spitzer, on Jackson's and Menke's method of preparing borneol from camphor.

January 31.—W. Biedermann, contributions to general nerve and muscle physiology (xiv. communication), on the heart of *Helix pomatia*.—G. von Niessl, on the astronomical relations at the meteoric fall of Mocs (Transylvania) on February 3, 1882.—L. Koller, on some general laws relating to knot-combinations.—A. Lustig, on the degeneration of the olfactory epithelium of rabbit after destruction of the olfactory lobes.—F. Zehden, attempt to explain the sunspots.—J. Hann, on the results of the meteorological observations made by Major von Machow at Pungo Andongo and Malunge in the interior of tropical South-West Africa in the years 1879-80.

February 7.—J. Odstrzil, on the mechanism of gravitation and inertia.—R. Benedikt and K. Hazura, on morin.—E. Goldstein, on the influence of conducting surfaces within the second stratum of the kathode light of Geissler's tubes.—S. Exner, on the innervation of the larynx.

February 14.—E. Hering, contributions to general nerve and muscle physiology (xv. communication), on the positive after-variation (*Nachschwankung*) of the nerve-current after electrical stimulation.—J. Klemencics, researches on the relation between electrostatic and electromagnetic measure.—F. von Hochstetter, seventh report of the Prehistoric Commission on its work during the year 1883.—R. von Wettstein, on the laws of growth of plant organs.

March 6.—J. Singer, contribution to a knowledge of the motor functions of the lumbar cord of the pigeon.—J. Redtenbacher, synopsis of the larvæ of Myrmeleoideæ.—J. H. List, on calyx-cells in the vesicle epithelium of the frog.—K. Zulkowsky, on coloured combinations of phenol with aromatic aldehydes.—F. von Hochstetter, reports of the Prehistoric Commission on the researches carried out in Moravia by J. Szombathy and W. Müller.—E. von Marenzeller, contribution to a knowledge of Adriatic annelids (iii. paper).—V. von Ebner, on the planes of solution of calcareous spar and aragonite.—H. Pitsch, on the value of Fermat's rule for the propagation of light in double refracting media.—Von Barth and M. Kretschy, on picrotoxin.—J. Herzig, studies on quercetin and its derivatives.—E. Häckel, gramina nova, vel minus nota.—A. Rosoll, contributions to the histochemistry of plants.—A. Adamkiewicz, on new stainings of the spinal cord.—F. K. Ginzel, researches on eclipses, especially on ascertaining empiric corrections of the orbit of the moon.

March 13.—E. Hering, contributions to general nerve and muscle physiology (xvi. communication), on the variations of nerve-current caused by unipolar stimulation in tetanisation.—C. Puschl, on the second axiom of mechanical theory of heat and on the behaviour of water.—K. Olzewski, on the liquefaction of hydrogen.—On the density of liquid oxygen, by the same.—On the point of solidification of some gases and liquids, by the same.—G. Adler, on the energy in the electrostatic field.—C. Goldstein, on the passing of electricity through vacua.

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