Nature. Vol. V, No. 122 February 29, 1872

London: Macmillan Journals, February 29, 1872

https://digital.library.wisc.edu/1711.dl/LBXITYVRTMAPI83

THURSDAY, FEBRUARY 29, 1872

SCIENCE STATIONS

WE shall not be far wrong, we imagine, in supposing that the article by Dr. Dohrn in a recent number of NATURE on "Zoological Stations" has attracted considerable attention among thoughtful men. We may, indeed, congratulate zoologists that so important a task has been taken in hand by one in every way so well fitted to accomplish it; and it will gratify our readers to learn that the cheery energy and bright enthusiasm of the German anatomist is fast overcoming the obstacles which his scheme naturally met with in the indolent city of the South, whose lands are so rich in classic ruins, and seas so full of Darwin-speaking embryos. At the risk of spoiling a good work we venture to add to his remarks some further suggestions, confining ourselves, however, to one or two points.

In the first place, we will be bold enough to express the doubt whether it will be advisable to separate so entirely, as Dr. Dohrn recommends, the stations in England from the work of teaching. The establishment of such stations will be rendered infinitely easier if they can in any way be made self-supporting. Dr. Dohrn hopes, if we understand him rightly, to pay the expenses of the Naples station out of the fees of the Gentile sightseers, who will be allowed to stroll about in the outer court of his embryological temple. There can be no such hope for any like English temple. Yet a very considerable share of the necessary funds might without difficulty be raised, and a Philistine British public might be made to believe that it was getting its money's worth for its money, if the work of teaching, which is palpable, which may be measured and valued, and for which a receipt in full may be given, were to go on hand in hand with the immeasurable and invaluable work of original inquiry. There would thus naturally grow up around the station a school of sound zoology; otherwise there would be great danger of its becoming a resort of ambitious *privat-docents* anxious chiefly to find a notochord where nobody had found it before, or a home of some narrow zoological clique.

Much might be said for the establishment somewhere on our British coasts of such a school of zoology on the theory of a geographical distribution of scholarship, and the existence of particular habitats best suited for particular branches of learning. Sufficient foundations for such a theory are at hand. It is easy to understand why Edinburgh, with her sea close by, has raised so many brilliant zoologists. We can see why Manchester in the past and in the present has done so much for chemistry. And, to look at the matter from another point of view, one gets a glimpse of the reason why high mathematics flourish at Cambridge, when one gazes at her fenny flats, where, if the conception of three dimensions be once reached, that of four is soon gained, and feels the fogs and mists which wash out of the mind everything that is not held fast by formulæ. The natural habitat for an English school of zoology is surely some bright spot on our southern coast.

Nor need such an institution necessarily have an independent isolated existence. There is too great a want of community in our English Universities and Colleges especially in matters of natural science. There is one zoology at Oxford, another at Cambridge, another at Jermyn Street, and these three have miserably little dealings with one another. What immeasurable good would a place of higher teaching do, where for a season, or for a term, the zoological students of all the Universities might mingle together with mutual diffusion of ideas! * The mere opportunity of material would be a great thing: the Cambridge student would lift his ideas above the line of beautifully prepared vertebrate skeletons, the Oxford man would benefit by the change of diet from Anodon and Astacus, and the London man would learn to see actual things instead of reading about them in books. But the greatest thing of all would be the catholic enthusiasm for biological learning, which such an institution could not fail to generate and foster.

Another remark which we would wish to make takes on somewhat the shape of a complaint against Dr. Dohrn, that he has confined to one science ideas which should properly belong to all the sciences of observation. It is well to have a Biological station, but it is far better to have a station at once Biological, Astronomical, and Meteorological. Let us imitate Dr. Dohrn in giving our views a concrete form. The eclipse party on their outward, and even on their homeward voyage, cannot fail to have been struck with the bright clear air of the North Red Sea. There is the very land of observation. It is impossible for any one with a fragment of a mind within him to sojourn on those delightful shores, where the eye rejoices in its power, where the air helps vision instead of hindering it, where the water is as clear and transparent as the air elsewhere, without the desire springing up to be a naturalist by day and an astronomer by night. And this blessed region is now little better than a week's journey from the fogs of London. Nothing could be easier than to establish at no great expense a Science Station at some spot on the shores of the Red Sea, a little south of Suez. Suez itself is for many reasons undesirable, but the little village of Tor suggests itself as being a very suitable neighbourhood. There would be comparatively little difficulty in getting supplies, or in going and coming to and fro. The naturalist, the astronomer, the meteorologist, with the Palestine explorer as an occasional helpmeet, might spend here a winter, or rather many winters, in which pleasure and profit would be running a hard race together.

We cannot help thinking that such an idea has only to be mooted to be at once caught up and set in action. The outlay of the initial building and arrangements need not be heavy, while the yearly expenditure might be kept within comparatively narrow limits. Such an undertaking is one which Government might justly take in hand, but it is also one which private liberality might largely aid, and to which contributions might come from the funds of our ancient seats of learning. In any case we fairly think it is matter deserving serious attention, and as such we leave it to our readers.

* It is impossible in a short article to develope a complete scheme; we might indicate our ideas, however, by suggesting that the right to study for one or more terms in the station might be granted as a sort of scholarship to promising biological students selected from all our great teaching institutions.

BURTON'S ZANZIBAR

Zanzibar: City, Island, and Coast. By Richard F. Burton. In 2 vols. (London: J. Murray, 1872.)

IN these two bulky volumes Captain Burton gives us, after a lapse of thirteen to sixteen years, a narrative of his adventures and explorations in the island of Zanzibar, the neighbouring smaller islands, the adjacent coast of the mainland, and the Highlands of Eastern Africa intervening between the coast and the great Victoria N'yanza, the publication having been delayed by a series of remarkable accidents. As in everything else that Captain Burton has written, the volumes are full of graphic delineations of the natural features and inhabitants of the country, combined with not a few details of a personal character which have not the same interest for the general reader.

In 1856 Captain Burton laid before the Royal Geographical Society his desire once more to explore Equatorial Africa; a committee was formed to assist him in his undertaking, a grant of 1,000*l.* was obtained from Lord Clarendon, then Secretary of State for Foreign Affairs, and on September 16th the enterprising traveller received formal permission, "in compliance with the request of the Royal Geographical Society, to be absent from duty as a regimental officer under the patronage of Her Majesty's Government, to be despatched into Equatorial Africa, for a period not exceeding two years, calculated from the date of departure from Bombay, upon the pay and allowances of his rank." On December 26th in that year he landed at Zanzibar, the first view of which is thus attractively described:—

"Earth, sea, and sky, all seemed wrapped in a soft and sensuous repose, in the tranquil life of the Lotos-eaters, in the swoon-like slumber of the Seven Sleepers, in the dreams of the Castle of Indolence. The sea of purest sapphire, which had not parted with its blue rays to the atmosphere—a frequent appearance near the equator—lay basking, lazy as the tropical man, under a blaze of sunshine which touched every object with a dull burnish of gold. The wave had hardly energy enough to dandle us, or to cream with snowy foam the yellow sandstrip which separated it from the underwood of dark metallic green. The breath of the ocean would hardly take the trouble to ruffle the fronds of the palm, which sprang like a living column, graceful and luxuriant, high above its subject growths. The bell-shaped convolvulus (*Ipomœa maritima*), supported by its juicy bed of greenery, had opened its pink eyes to the light of day, but was languidly closing them, as though gazing on the face of heaven were too much exertion. The island itself seemed over-indolent and unwilling to rise; it showed no trace of mountain or crag, but all was voluptuous with gentle swellings, with the rounded contours of the girl-negress, and the brown-red tintage of its warm skin showed through its gauzy attire of green. And over all bent lovingly a dome of glowing azure, reflecting its splendours upon the nether world, whilst every feature was hazy and mellow, as if viewed through 'woven air,' and not through vulgar atmosphere."

A residence, however, of some months in the island by no means established the impression which its first appearance might convey, of its being a terrestrial paradise. The city of Zanzibar itself is a miserable, ill-built place, fœtid and unhealthy; while the personal appearance and habits of the natives are repulsive in the extreme. The climate is remarkably uniform as to temperature, the result of nine months' observation showing a range of 18°—19° F. only. The medium temperature of January is 83·5°; of February, the hottest month in the year, about 85°; and the mean gradually declines till July, the coolest month, 77°. The mean average of the year is between 79° and 80°. The barometer is almost uniformly sluggish and quiescent, a few tenths above or below 30 in. representing the maximum variation, even under the influence of a tornado. Uniform, however, as is the temperature, the degree of humidity of the atmosphere varies excessively. At certain seasons the amount of moisture exceeds that of the dampest parts of India, and the annual rain-fall is in some years double that of Bombay, varying from 100 to 167 inches. The Msika, or principal rainy season, lasts from April to June; the island is enveloped in a blue mist, and the interior becomes a hot-bed of disease; the hair and skin are dank and sodden; shoes exposed to the air soon fall to pieces; paper runs and furniture sweats; the houses leak; books and papers are pasted together; ink is covered with green fur; linens and cottons grow mouldy; and broadcloths stiffen and become boardy. This excess of damp is occasionally varied by the extreme of dryness. During the prevalence of the dry wind cotton cloth feels hard and crisp, books and papers curl up and crack, and even the water is cooled by the excessive evaporation. Earthquakes are all but unknown in Zanzibar, a single shock being recorded as having been felt in 1846. Tornadoes are frequent, but the cyclones and hurricanes of the East Indian islands rarely extend to this coast. During fourteen years there was but one tourbillon strong enough to uproot a cocoa-nut tree.

The prosperity of Zanzibar depends almost entirely on its vegetable productions, and chiefly on the cocoa-nut and the clove. The former supplies the natives with nearly all their wants—food, wine, spirit, cords, mats, strainers, tinder, firewood, timber for houses and palings, boats and sails; and Captain Burton calculates that in 1856 12,000,000 nuts were exported for the soap and candle trades. The sugar-cane might be grown to great advantage, but for the constitutional indolence of the inhabitants. Cotton has been tried, but does not thrive; and coffee has not been cultivated to any extent. The fruits in greatest request by the islanders are the mango, the orange, the banana or plantain, the pine-apple, and the bread-fruit—all, however, with the exception of the banana and an inferior kind of orange, being introduced exotics; the pine-apple has become perfectly naturalised. The most important production of the island is the clove, which does not, however, produce crops comparable to those of the East Indies either in quantity or quality, owing to want of skill and intelligence in its cultivation. The copal of commerce is obtained chiefly from the neighbourhood of Saadani, on the opposite coast of the mainland; and Captain Burton entirely confirms the account of its production already communicated to the Linnean Society by Dr. Kirk, that it is a gum, or resin, exuding from wounds in the stem of a small tree or large shrub (*Hymenœa verrucosa*) belonging to the order Leguminosæ.

Captain Burton's first expedition from Zanzibar was to the smaller island of Pemba, lying to the north, and thence to Mombasah, on the coast 4° south of the line, the capital of Northern Zanzibar, the best harbour on the Zanzibar coast, land-locked by coral islands. The town itself is built on the largest of these islands, where the climate is hotter, drier, and healthier than that of Zanzibar. Here he did not attempt to strike inland, the weather and the hostility of the native tribes being unfavourable, but returned along the coast southwards to Pangani, and thence inland to Fuga, the capital "city" of Usambara, in the Highlands of Eastern Africa. In order to gain a complete knowledge of the Zanzibar coast, he also paid a visit to the island and port of Kilwa, situated beneath the ninth degree of south latitude. Here are the remains of an ancient town of considerable size, with respect to which many legends are current among the natives; but the gradual sinking of the coast has rendered the ancient site uninhabitable. Although at the present time a miserable and fœtid collection of squalid huts, Kilwa was found in 1500 by the Portuguese a town of great prosperity, the capital of Southern Zanzibar, and ruling the coast as far as Mozambique and Sofala; but the curses of European wars and the slave-trade have desolated the once thriving country. Captain Burton does not think very highly of the so-called "free labour" system, which he terms "the latest and most civilised form of slavery in East and West Africa."

The most important expedition made by Captain Burton was, however, that undertaken between 1857 and 1859 to Kazeh in the Ukimbu district, upwards of 500 miles from the coast, and about 2° south of the southern shore of the great Victoria N'yanza, in company with Captain Speke. But as this journey has already been illustrated in his own "Lake Regions of Central Africa," and the country has been further described by Colonel Grant and Captain Speke, he does not again enter into details respecting it; but thus sums up what he considers its geographical results:—"That the Boringo is a lake distinct from the 'Victoria N'yanza' with a northern effluent the Nyarus, and therefore it is fresh water; that the N'yanza, Ukara, Ukerewe, Garawa, or Bahari y a Pili, is a long narrow formation, perhaps thirty miles broad, and 240 miles in circumference, and possibly drained to the Nile by a navigable channel; that the N'yanza is a water, possibly a swamp, but evidently distinct from the two mentioned above, flooding the lands to the south, showing no signs of depth, and swelling during the low season of the Nile, and *vice versâ;* and that the northern and north-western portions of the so-called 'Victoria N'yanza' must be divided into three independent broads or lakes, one of them marshy, reed-margined, and probably shallow, in order to account for the three effluents within a little more than sixty miles."

The botanical results of this journey are about to be illustrated by Colonel Grant, in a magnificent volume, to be published by the Linnean Society, which it is understood will be illustrated by 600 plates, the cost of which will be defrayed entirely by the gallant author.

One chapter is devoted to a sketch of the labours of Captain Burton's old comrade, Captain Speke. Though tribute is here paid to his many excellent qualities, we regret to be again introduced to the details of the estrangement which grew up between the explorers, culminating at the meeting of the British Association at Bath, when the two companions in arms met as strangers, advocates of two rival "Nile-theories," as to the origin of the Father of rivers.

In the Appendices, Captain Burton gives some useful details of the meteorology, commerce, &c., of Zanzibar. A well-executed map helps to illustrate the author's journeys, without a constant reference to which the narrative is by no means clear; but we cannot commend the style in which the woodcuts interspersed here and there are executed.

OUR BOOK SHELF

Deschanel's Natural Philosophy. By Prof. Everett. Part III., Electricity and Magnetism. (London and Edinburgh: Blackie and Son.)

IN the Preface by the translator of the present volume, it is said, with much truth, that "the accurate method of treating electrical subjects, which has been established in this country by Sir W. Thomson and his coadjutors, has not yet been adopted in France; and some of Faraday's electromagnetic work appears still to be very imperfectly appreciated by French writers." Accordingly we find that the translator has added a considerable amount of matter, and more especially two important chapters, one on the electrical potential and lines of electric force, and the other on electrometers, together with an appendix on electrical and magnetic units. Dr. Everett has thus considerably improved a book, which, in its original form, was already a good one. The ordinary branches of the subject are unfolded, the plates are good, and the explanations are full and clear. The portion devoted to magnetism is in this, as apparently in all such general treatises on natural philosophy, considerably the most defective part, and especially in the sections which relate to terrestrial magnetism. The whole of that question is most insufficiently dealt with. The treatment of the secular changes in the magnetic elements is confined to twelve lines, where it is said that "declination and dip vary greatly, not only from place to place, but from time to time;" but from which we should expect that the unlearned reader would be led into the error that intensity is uniform. Then, again, the vast subject of changes in the elements, such as are not secular, is confined to one short paragraph, headed "Magnetic Storms"! The intrinsic importance of the subject of terrestrial magnetism, and the great and increasing interest attaching to it, no less than the extreme beauty of many of its investigations and results, entitle it to a much larger notice than the very imperfect one in this volume. The chapter on the Telegraph contains useful matter, and especially a description of an autographic telegraph, an instrument which, while interesting and ingenious, has not often found its way into such treatises. We miss such points as how to find the locality of a fault in a telegraph wire, which we might the more expect to see treated of when we consider the full explanation which is given of Ohm's laws, and when we see such elaborate details as to some telegraphic instruments as are entered into in the chapter in question. The chapters on the heating effects of currents, and on electrolysis, are clear. The question of electromotive force, and of the means of determining it, might have been entered into more fully; and, generally, from the character of the chapter on the potential, we might have expected to see a little more introduced concerning points which may be elucidated by the application of the principle of the conservation of energy.

JAMES STUART

Medizinische Jahrbücher, herausgegeben von der k. k. Gesellschaft der Ärzte, redigirt von S. Stricker. Jahrgang 1871. Heft iv. Mit 4 Holzschnitten. (Wien: 1871.)

THIS part, which concludes the first volume of Stricker's Jahrbuch, contains: (1) Researches on the Inorganic Constituents of the Blood, by Adolph Jarisch. Jarisch gives the details of an improved method by which blood can be collected from the vessels of a dog without the loss of any of the water by evaporation, whilst at the same time, being frozen, it loses its disposition to coagulate, and when subsequently thawed can be readily manipulated. The mean of four analyses gave the following results:—

Phosphoric acid anhydride	0·1103
Sulphuric acid anhydride	0·0358
Chlorine	0·2805
Potash	0·0342
Soda	0·3748
Lime	0·0112
Magnesia	0·0058
Oxide of iron	0·0948
Total ash found	0·8922
Calculated	0·8640

In Verdeil's treatise, the amount of ashes of fresh blood is stated to be on the average 6·45 per cent. Jarisch points out that this must be an error of the press, his own results giving only 0·864 per cent., a difference that is too great to be regarded as an error of analysis. 2. An essay on the Centres of Vascular Nerves, by Dr. Soboroff. In this paper Dr. Soboroff shows from the results of experiments performed on frogs that the nerves supplying the vessels of the web of the foot proceed from the spinal cord, and run into the sciatic nerve. 3. On the presence of Fungi in the Blood of Healthy Men, by Adolph Lorstorfer. Lorstorfer drew blood from the fingers of eleven people who considered themselves in perfect health with every precaution to avoid contamination with dirt, and examined the specimens daily with a Hartnack microscope, ocular 3, objective 10. During the first two days he observed nothing remarkable, except in some cases a few scattered groups of small granules. On the third day similar groups were always found, though still scattered. The granules were of equal size, considerably larger than those of the colourless blood corpuscles, but without any definite arrangement. On the fourth day they had increased in size, and were arranged in groups of four, so as to resemble the well-known *Sarcina ventriculi*. On the fifth day the granules had slightly increased in number and size, but after this date no change was observable up to the tenth day, when the preparations became unserviceable. Lorstorfer thinks his experiments render it probable that the germs of *Sarcina ventriculi* exist in the blood as a natural condition. There are three other papers, but they are all of a purely professional nature. One being by Hofmokl on Resection of the Upper and Lower Jaw: one by Bresslauer on Typhus: and one by Popoff on Pneumonia.

H. P.

LETTERS TO THE EDITOR

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

Development of Barometric Depressions

I HAVE only just had my attention called to the critique on "The Laws of the Winds prevailing in Western Europe," in NATURE of Jan. 11, which I have seen to-day for the first time. Though it is now rather late to do so, I may perhaps be permitted to point out some unintentional misrepresentations of my views into which the writer appears to me to have fallen.

He considers it improbable in the extreme that the course of baric depressions should be regulated "by one law" in intra-tropical, and by "a totally distinct law" in extra-tropical regions of the globe. I pointed out (pp. 40, 41) that in temperate latitudes the general distribution of atmospheric pressure commonly tends to transfer local depressions in an eastward direction; while the influence of precipitation resulting from the mean distribution of solar heat propagates them in the same direction. Since the reversal of pressure-distribution which accompanies polar periods only retards the eastward progression, I drew the conclusion that, in temperate latitudes, the most important of the two factors of the progression is the influence of precipitation, and accordingly I devoted the first part of my work to this, with the promise (which I hope shortly to redeem) that the motive effect of the general pressure-distribution shall be described in Part II. All this your reviewer ignores. Had I been engaged in a discussion of the tropical cyclones, I should have proceeded in an inverse order; since the most important factor of their westward progression appears to be the mechanical influence of the distribution of surrounding pressures. It is, however, important to observe that as in temperate, so in tropical latitudes, these two influences are commonly coincident in direction. In the West Indies, *e.g.*—at those periods when cyclones prevail—mean temperatures are lower on the south, or left, than on the north, or right, of their course; and a similar remark applies, *mutatis mutandis*, to the typhoons of the Indian and China seas.

Briefly, my position is this. The influence of the general distribution of temperatures, and that of the general distribution of pressures, may be practically regarded as two forces, A and B, from which the progression of local depressions results. Both of these commonly act in the same direction—in temperate latitudes producing eastward, and in tropical westward, progression. But of these A is the preponderating influence in temperate, B in tropical latitudes; partly because the influence of precipitation on the surface-currents increases with diminution of temperature, and partly because the currents resulting from the general distribution of pressures are far more constant and of vastly greater extent, in proportion to the extent of the cyclones, in tropical than in temperate latitudes. I am convinced that the attempt to simplify the rules which regulate the progression of depressions by striking out either of these factors, or by the substitution of J. K. L.'s single law, will meet, as it has hitherto met, with failure.

Your reviewer also ignores what I have said (pp. 28, 29) as to the occurrence of heavy precipitations unproductive of baric depression, and thinks it necessary to travel to Khasia or to the Himalayas to find illustrations of a truth which it was never intended to deny. Every one conversant, as he considers me to be, with the meteorology of Western Europe alone, is aware that heavy and extensive precipitation not uncommonly occurs without producing retrograde circulation (and sometimes with generally increasing pressures), where antecedent atmospheric conditions do not favour such developments. The reviewer concedes that the immense precipitation in the Himalayas "probably causes a very great barometric depression;" a concession which is not to be accepted, both because such a reference to antecedent probabilities is inapplicable to empirical science, and because the fact itself may be denied. But supposing this great Himalayan depression to exist, and no retrograde circulation (as J. K. L. maintains) to be developed around it, his discovery of a region in which "Ballot's rules" are contravened, is indeed one of no small importance.

Into the wide question of the influence of the earth's rotation I will not here enter, further than to remark that the hitherto admitted universality of the rules connecting the direction of all atmospheric currents with the distribution of surrounding pressures, and the variation of these rules in the two hemispheres, appears to have been satisfactorily accounted for by attributing it to the earth's rotation; while it has never been, with much plausibility, traced to any other cause or combination of causes.

Hereford, Feb. 17

W. CLEMENT LEY

Zoological Nomenclature

IN the President's address to the Entomological Society of London recently given by Mr. Wallace, one of the points most fully discussed is the rules of zoological nomenclature. These rules are undoubtedly of very considerable, though indirect, importance to science, and it is not very satisfactory to find that great divergence of opinion as to what these rules are, or should be, still prevails amongst recent describers and cataloguers.

Some years ago I was entrusted by the Entomological Society with the task of preparing a synonymical catalogue of the Coleoptera of our islands, to be published under the auspices of the Society; my attention, therefore, has necessarily been directed to the questions under discussion in this matter, and I will here state the conclusions to which I have come.

1st. That a committee to frame and publish laws on zoological nomenclature is not to be desired. Such committee would have no power whatever to enforce the laws it might make, and could not be expected to put an end to discussion on these points. The knot must be untied, not cut.

2nd. That the binomial system of nomenclature should not be arbitrarily considered to have commenced at any given date; but that recognisable names in all works in which this system is methodically employed should be used according to the rule of priority.

3rd. That it is not necessary to suppress a generic name in zoology because it has been previously used in botany (or *vice versa*); but that it is much to be regretted that any generic name should thus be in double use, and it should always be made matter of reproach to an author that he has committed an act of this nature.

4th. That names must be Latin to the extent that renders them capable of being written or used in scientific Latin; but that classical emendations beyond this are entirely inadmissible; no line except this can be drawn between emendation, alteration, and total suppression. The laws of classical languages have, *per se*, no more right over scientific nomenclature than has the Hindoo language. As regards the much talked-of "Amphionycha knownothing," it should be latinised in the simplest manner, as *Amphionycha knownothinga;* and I would further suggest that its barbarian author be well hissed whenever he ventures to show his face in a scientific assembly.

5th. That as regards placing an author's name after a species, the name so placed should always be that of the first describer of the species; not because he has any right in the matter, but as an additional means of certainty, and as a security against change.

6th. That the specific name is the name of an object, and therefore a noun, and should be changed in gender, or any other manner, when removed from one genus to another.

7th. That it is very undesirable to use the same specific name in two closely-allied genera; but that where this has been done already no alteration should be made till the two names actually come into collision on account of the two genera being united as one genus. Surely to act otherwise is like cutting one's throat for fear somebody else should do it.

8th. That as regards placing an author's name after a genus, the name so placed should be that of the author who established the genus in the sense in which it is actually used. *Carabus* of Linnæus included all the insects now comprised in the family *Carabidæ*, at present divided into several hundreds of genera. To write, therefore, *Carabus* Linn., when we mean something entirely different, may be usual but is not desirable.

I may add, that I consider it useless to expect a perfectly stable zoological nomenclature, until zoology itself is complete and perfect; but that in order to reduce changes to a minimum, classical and other secondary claims must not be allowed any great importance.

D. SHARP

Thornhill, Dumfriesshir

Deep-Sea Soundings

IN reference to the very interesting article in NATURE for February 22, "American Deep-Sea Soundings," may I be permitted to make the following remarks:—It is there stated that the water-collecting cylinder is apt to lead to incorrect conclusions in regard to the gaseous ingredients of sea water obtained by its means from great depths, owing to the escape of a portion of the gases when the pressure is relieved by the cylinder being drawn to the surface. As a member of the *Porcupine* expeditions of 1869 and 1870, I had nearly eight weeks' constant daily experience in the examination of samples of abyssal water thus obtained, and I believe that I was the first to adapt the gas analysis apparatus of the late Prof. W. A. Miller to the exigencies of a laboratory on board ship. The general result of these experiments for 1869 will be found as an appendix in No. 121 of the Proceedings of the Royal Society. My object in writing now is to point out that if there were such an escape of gaseous ingredients as is indicated above, the abyssal water would be so saturated with them at the ordinary atmospheric pressure (*i.e.* after the sample was removed from the water cylinder in the laboratory), that the least elevation of temperature would be sufficient to cause a further quantity to be given off. This, however, never was the case, since I invariably noticed that there was no appearance of bubbles of gas, until the water had been heated above 120° Fahr., and frequently still hotter. I may add that the only samples of water which appeared saturated with gaseous ingredients were those taken at the surface, afte several hours of strong wind. I must confess that after giving a good deal of thought to the subject, and conversing with friends whose knowledge of physics is far greater than mine, who agree with my view of the matter, I am unable to see any reason why we should expect to find any greater quantity of gaseous ingredients in abyssal than in surface water. No doubt, if the excess were there the enormous pressure would retain it, but where is the source of the supply of the supposed excess? I have never seen a satisfactory answer to this question. The solvent is exposed to excessive pressure, but the gases to be dissolved in it are not, unless there is any evolution of gas at those depths. It is probable that this abyssal water was at some point in its circulation near the surface, when an interchange would take place between some of its dissolved carbonic acid and the oxygen of the atmosphere. And it appears to me that it is only when the particles of sea water are near the surface, and exposed to no excess of pressure, that they dissolve their gaseous ingredients, which are afterwards modified in their composition by the animal life on the sea bottom.

WILLIAM LANT CARPENTER

Clifton, Bristol, February 26

Snow at the Mouth of a Fiery Furnace

IT would be interesting to ascertain the temperature of the saltatory drops noticed by Mr. H. W. Preece. Sudden and excessive evaporation may have produced actual congelation.

HENRY H. HIGGINS

ON THE SPECTRUM OF THE ATMOSPHERE

DURING the voyage out to India of the Eclipse Expedition, I took every opportunity of observing carefully the spectrum given at sunrise, compared with that at sun-high, and obtained the following results, which, though poor in themselves, will show the wide field open for further research.

When leaving England, and for some way into the Mediterranean, the length of the spectrum as seen at sunrise extended generally from about B in the red to near G in the violet. Great differences were, however, presented in the absorption-lines according to the state of the weather, or perhaps rather according to the state of the sky when the sun rose.

If the sun rose among yellow tinted clouds, the absorption bands about B, C, between C and D, and near D, were exceedingly well defined; at the same time the blue end did not extend so far as usual, showing that there was more absorption of the blue, while probably the greater quantity of aqueous vapour in the air reflected the red and yellow rays. In these cases the tint of the clouds generally changed to a rosy red shortly after sunrise.

A clear sunrise, on the contrary, showed an extension of the violet end, whilst the aqueous bands at B, C, and D were less defined, as if the red and yellow light were not so strong to show them out by contrast.

On passing through the Suez Canal and down the Red Sea the spectrum was shortened at both ends, leaving from little beyond C to a third from F to G; this would seem to show a general absorption going on in the atmosphere from some cause, probably light dust in the air. This idea is strengthened by the beautiful purple colour of the distant mountains, as if, though the violet rays were greatly absorbed, the red rays were so to a less degree, whilst the want of aqueous vapour allowed nearly all the yellow rays to be transmitted.

When clear of the Red Sea in the Indian Ocean, the blue became greatly reduced, and the red end extended to A; the aqueous bands were very strong indeed, so much so that on two mornings D_1 and D_2 could hardly be distinguished amid the black mass that surrounded them; the lines near C and C' or γ of Brewster were sharp and clear.

On nearing India another change took place; the blue continued to be absorbed, till at sunrise the spectrum could hardly be seen beyond F, but the blue green became very bright, and the dark bands between *b* and F very distinct, the lines commencing at 1825 Kirchhoff especially attracted notice, standing out sharp and distinct, so as at first to be mistaken for F: those nearer F at 1890 K showed as a clear broad band, but not nearly so black as 1825. I am not prepared to give an explanation of this phenomenon, but will remark that when the sun rose clear and free from clouds the aqueous bands to D were less distinct, while the atmospheric bands from D to E were clear and sharp, and those beyond *b* remarkably so. But if the sun rose among clouds, these were generally tinted with a golden yellow, changing afterwards to a rose or red colour, and, as might be expected, the lines from B to D and just beyond D_1 were well defined, whilst from E to near F the spectrum was not so clear.

After this the duties of preparing the instruments for the eclipse prevented my taking any observations, as most of our work was done in the early morning. But after the eclipse, whilst on the Neilgherry Hills, 6,000 feet above the sea, I had an opportunity of finding that the strong line at 1825 had nearly faded away. The weather was then fine, but misty. A few days after, on going down the Ghauts to Bombay, I was struck with the blue colour of the mist that was hanging about the valleys, and I examined it with the spectroscope; the blue extended much farther than usual, and the lines between *b* and F were again distinct.

On the passage home the same results were obtained as on going out; but as I had a much smaller spectroscope I could not make the observations with the same accuracy as before. When passing up the Red Sea the absorption was evident at both ends of the spectrum, and the mountains were of the same beautiful purple colour that I had noticed before.

From Alexandria to Southampton we had very bad weather, constant gales, making it difficult to observe. But I got the following results: With a cloudy sky at sunrise, and appearance of wet weather, the bands from B to beyond D (δ of Brewster) were strong, whilst the blue end of the spectrum was greatly absorbed, and the lines from *b* to F were less distinct; this was reversed with clear weather. As we gained higher latitudes, the blue end of the spectrum lengthened out, and the bands beyond F, particularly about 2330 K, became distinct, while the bands 1825 K and 1890 K gradually faded, and now their intensity is not one-fourth of what I observed it in the Indian Ocean.

These observations are very imperfect, but I hope, if I can get the instruments, to carry out a more perfect system of observation, feeling sure that it is a subject worthy of great consideration in meteorology, especially when taken in connection with the temperature and pressure of the atmosphere and the state of the weather.

Shanklin, Feb. 5 J. P. MACLEAR

PROF. AGASSIZ'S EXPEDITION

IT is probable that I may have been anticipated, as regards part of the present communication. If not, I believe that many of your readers will be glad to learn the objects with which Prof. Agassiz has started, with Count Pourtales and a distinguished band of skilled observers, on a scientific expedition in the United States' surveying ship *Hassler*, and to receive a brief account of what he has already done at St. Thomas and Barbados, at which places he was obliged to touch, in consequence of defects in the vessel or her machinery.

The Professor's chief objects are stated in a letter from himself to Prof. Peirce, the Superintendent of the U.S. Coast Survey. (See NATURE, vol. V., p. 194.)

The Expedition was detained some days at St. Thomas, and the time of the Professor and his assistants was devoted chiefly to the collection and preparation of fishes, with a view to the study of the brain, and the breathing and digestive organs. Several boxes full, preserved in alcohol, were at once shipped to the United States, as the first-fruits of the Expedition.

The party arrived at Barbados on December 26, and spent four days there. The first two were devoted by the Professor to examining and studying the large collection of West Indian shells, marine and terrestrial, of corals, sponges, crustacea, and semi-fossil shells of the island, made by the Governor, Mr. Rawson. Of the marine series he wrote in the following terms to Mr. J. G. Anthony, the Curator of the Harvard Museum:—"I am having high carnival. I have found here what I did not expect to find anywhere in the world—a collection of shells in which the young are put up with as much care as the adult, and extensive series of specimens show the whole range of changes of the species, from the formation of the nucleus to the adult." He was particularly struck with the now unique specimen of *Holopus*, lately procured by Mr. Rawson, which was described by Dr. J. E. Gray in the December number of the "Annals of Natural History," and named by him, from a drawing, *H. Rawsoni*, but which Agassiz, who had seen the specimen of D'Orbigny in Paris, before it disappeared, considers to be a normal specimen of *H. Ranzii*, which had only four, instead of five arms. Count Pourtales recognised among the corals several similar to those which he had obtained by dredging in or near the Gulf Stream, and described in the latest No. (4) of the "Illustrated Catalogue of the Museum of Comparative Zoology at Harvard College," the presence of which on the coast of Barbados serves to indicate the close similarity of submarine life in those two distant localities.

The next two days, or rather the night of the next, and the greater part of the following day, were spent in dredging in the neighbourhood, in a depth of 60 to 120 fathoms, about a mile from the shore, whence Mr. Rawson has procured his fine specimens of *Pentacrinus Mülleri*. The *Holopus* was found on the opposite side of the island. The results were beyond the expectations, or even the hopes, of the most sanguine of the party. Only dead fragments of the *Pentacrinus* were obtained, but among the abundant spoils were four specimens of a new genus of Crinoid, without arms on the stem, (like *Rhizocrinus?*) which remained alive, with the arms in motion, until noon on the following day, under the excited observation of the party. A number of deep-sea corals, alive, crustacea, sea urchins of new species, star fish, sponges, crystalline, jurassic, and corallines, &c., and a rich harvest of shells, were obtained. Among these was a splendid live specimen of *Pleurotomaria Quoyana*, F and B, of which genus Chenu writes that only one living species, and of that only one specimen, is known. The animal exhibited remarkable affinities, and the artist accompanying the expedition was able to take several sketches of it. A large *Oniscia*, shaped like *O. cancellata* Sow. but with an orange inner lip (*O. Dennisoni?*), some specimens of *Phorus Indicus* Gmel., a magnificent new species of *Latiaxis*, with many exquisite specimens of *Pleurotoma*, *Fusus*, *Murex*, *Scalaria*, and three or four of *Pedicularia sicula* Sw., with innumerable Pteropods and Terebratulinæ, rewarded these "burglars of the deep." The Professor was delighted, and it was with reluctance he abandoned so rich a field in order to secure his passing through the Straits of Magellan at a right season.

Barbados, January 26 R. W. R.

ETHNOLOGY AND SPIRITUALISM

THE *Academy* of February 15 contains a review by Mr. A. R. Wallace, of my "Primitive Culture," where he raises a point on which I wish to make some further observations; but inasmuch as the form of publication of that journal adapts it rather to criticism than to correspondence, I ask leave to change the *venue*, and make my remarks in the columns of NATURE.

In "Primitive Culture" (Vol. i., pp. 279-84), I have given an account of the widespread popular belief in "were-wolves," including under this heading the analogous belief in man-hyænas, man-tigers, &c. According to this superstition, certain human beings are considered to be temporarily transformed into wolves, hyænas, or tigers, and in these shapes to go about preying on mankind. While expressing an opinion that "the origin of this idea is by no means sufficiently explained," I have offered two suggestions as bearing on its prevalence in the world: first, that such notions are consistent with the familiar doctrines of the lower culture as to transmigration of souls and transformation of bodies; second, that certain insane persons do actually suffer under the delusion that this transformation (the idea of which popular belief has put into their minds) has really happened to themselves, and they prowl about like wild beasts accordingly. Mr. Wallace disapproves of this treatment of the subject, and propounds a view of his own, as follows: "A recognition of the now well-established phenomena of mesmerism would have enabled Mr. Tylor to give a far more rational explanation of were-wolves and analogous beliefs than he offers us. Were-wolves were probably men who had exceptional power of acting upon certain sensitive individuals, and could make them, when so acted upon, believe they saw what the mesmeriser pleased; and who used this power for bad purposes. This will explain most of the alleged facts, without resorting to the short and easy method of rejecting them as the results of mere morbid imagination and gross credulity."

Let me now first observe that Mr. Wallace's explanation does not supersede my suggestions; indeed, he meets neither of the points which I endeavour, however tentatively, to deal with. He offers nothing like a reason why knavish sorcerers in districts of Europe, Asia, Africa, and America should have all hit upon the device of imposing the same peculiar delusion upon their dupes; nor does he account for the fact, vouched for by satisfactory evidence, that in certain cases the supposed were-wolf is himself utterly persuaded of the reality of his own transformation, and goes to execution believing in his offence. The proofs are, I think, convincing, here as elsewhere in the history of magic, that sorcerers were originally and still are usually more or less believers in their own magical pretensions—though very many used and use fraudulent means to enhance their supposed powers; and some, who may be reckoned among the vilest of the human race, are simply professional impostors. Yet Mr. Wallace's suggestion, though it does not do away with the need of mine, seems to me valuable as a well-directed attempt to explain a part of the matter left untouched by me. His theory that a were-wolf may be a person possessed of the peculiar faculty exerted by mesmerists, of making others delusively imagine that they see and hear what in fact does not happen, is a theory at any rate plausible, and possibly on the track of explaining much of the power belonging to sorcerers, savage and other. (I may remark incidentally that the power of mesmerists in producing anæsthesia and working on the imagination of their patients has never been contradicted by me.) Now, without committing myself to Mr. Wallace's idea, beyond saying that it is plausible and worth pursuing, I proceed to apply it somewhat farther. Granting that a were-wolf, in virtue of being a person capable of exerting mesmeric influence, can delude people, and even assemblies of people, into fancying that they perceive monstrous unrealities, the question arises, Was any one with this were-wolf-faculty present in the room when Mrs. Guppy made her celebrated aërostatic entrance? Is Mr. D. D. Home a were-wolf? Is a professional "medium" usually or ever a person who has the power of acting on the minds of sensitive spectators, so as to make them believe they see what he pleases? Pursuing this subject yet a step farther, I have now to call Mr. Wallace's attention to an interesting fact. The sorcerers of the Abipones of South America, who by mere roaring within their tents threw the credulous savages into agonies of panic terror, caused by vivid belief that tiger-spots were in the act of coming on their (the sorcerers') bodies, that their nails were growing into claws, that they were actually transforming themselves into tigers, deadly though invisible—these sorcerers were actually the professional spiritualistic mediums of the tribe, part of whose business it was to hold intercourse with the spirits of the dead, causing them to appear visibly, or carrying on audible dialogues with them behind a curtain. Mr. Wallace, as the most eminent scientific man who has taken up what are known as modern "spiritualistic doctrines," no doubt has the ear of all who hold these doctrines. I think it may bring about investigations leading to valuable results if Mr. Wallace will inform spiritualists with the weight of his authority that he believes in the existence of a class of men who, in his words, have exceptional power of acting upon certain sensitive individuals, and can make them, when so acted upon, believe they see what the mesmeriser pleases, and who use this power for bad purposes.

With reference to other parts of Mr. Wallace's review of my work, I have to thank him for several valuable comments, while, at the same time, I venture to express an opinion that some of his objections to my ethnological treatment of spiritualism are unreasonable, and especially I wonder that so serious a student of natural science should make it a ground of complaint against me that in treating of difficult and important problems I consider it necessary to bring forward copious and widely distributed evidence. But rejoinders to reviews are seldom desirable in themselves, and my justification for the present note lies in the importance of drawing attention to a matter worth considering by persons on both sides of the spiritualistic controversy.

E. B. TYLOR

DREDGING EXPEDITIONS

THE occasion of an American Dredging Expedition recently starting, leads us to make the following remarks on such Expeditions in general, more especially upon one whose programme has lately come to our ears.

England has perhaps of all countries done the most for dredging. We have only to point to such names as Forbes, Ball, McAndrew, Wallich, Jeffreys, Wyville Thomson, and Carpenter, as among the landmarks in the cause. Indeed, for many years coast dredging has been a popular amusement with the marine naturalist and collector, and many a prize has been in this manner turned up.

In 1868 Messrs. Carpenter, Thomson, and Jeffreys were fortunate enough to obtain the use, free of expense, of a Government steamer, and, armed with a substantial grant from the Royal Society, tried their luck in the deep sea. The following year the Government again gave them the use of a vessel, and the Royal Society a further grant of 200*l*. Again in 1870 they went out at the country's expense. The great and important results obtained during these cruises are pretty well known to the scientific world, and it is unnecessary to repeat them here.

In the year last mentioned an unheard-of circumstance took place. An English yachtsman, Mr. Marshall

Hall, not only gave up the use of his yacht for the summer in the cause of Science, but bore nearly the whole expense of the cruise himself. The naturalist who accompanied them was Mr. Kent, of the British Museum, a man comparatively unknown before that time; and this was, perhaps, the reason why the Royal Society could only afford to give £50 towards the expense of apparatus, &c. As a natural consequence, the expedition was considerably crippled for want of proper gear, and they were unable to attempt deep-sea work. It is too rare for persons who are blessed with means to assist Science in any way, and when such an act of generosity does take place, it ought not to be forgotten on the part of the scientific public. Yet it is rumoured that a similar expedition to Morocco and Madeira, which Mr. Marshall Hall is arranging for the spring, is likely to be received with some coldness by some influential members of the scientific brotherhood. We sincerely hope that the rumour is incorrect.

It appears that Mr. Marshall Hall proposes to be absent from England for between three and four months; and, besides the natural history, to investigate, as far as possible, certain chemical and physical questions concerning the deep sea and its currents in the neighbourhood of the above-mentioned places. He is taking with him a young naturalist, Mr. P. T. Abraham, B.A., B.Sc., lately from Dublin, at which University he came out first in natural science honours, and where he has gained a high reputation for zoological knowledge. It is also probable that another naturalist will make up the staff. These gentlemen intend to give, besides the use of the yacht, 150*l.* or so—as much as they are able. The remaining 250*l.*—for the total cost of the expedition could not amount to much less than 400*l.*, when the items of gear, apparatus, outfit, and maintenance for such a time are taken into consideration—they hope to obtain in the form of grants from the learned societies. We feel sure that the Royal Society will be among the first to endow the work out of the fund placed at their disposal by the Government, and the best friends of Biology may wish that they had more frequent opportunities afforded them of assisting in researches in which it is fitting that in the first instance a private individual should come forward.

It is possible even that other societies may be induced to help if they have funds at their disposal. Among such societies we may mention the Zoological Society, which contains on its roll the names of men of the first rank in every department of zoology. It is true that a great portion of the funds are expended in the direction of the higher vertebrates, and that the lower animals do not receive the attention they may deserve; but still, it must be remembered that the great object of the society is the popularisation of natural history.

We hope that the *Norna's* will not be the only dredging excursion starting from British waters this year. The field that has been so ably opened up by Dr. Carpenter and his colleagues ought not to be allowed to slip away altogether from the hands of Englishmen. We know too well that other nations are not backward in following up and eclipsing the work that British pluck and genius have been the first to venture upon. The Americans are on the track, and our Continental neighbours will not be far behind.

We are glad that the extended circumnavigation expedition is in process, and we believe that if nothing unforseen occurs, Prof. Wyville Thomson, with a staff of competent aids, will sail in the autumn on their long journey, which cannot fail to have the most important bearing on our future advance in such studies. Such a journey as this, however, instead of making more modest dredging operations of no avail, vastly increases their importance; and it is not too much to hope that the time is not far distant when men of money and leisure will more generally occupy their time in such pursuits.

SOLAR HEAT

THE calculations presented by Père Secchi, in his work "Le Soleil," relative to solar temperature and solar radiation, tending to discredit the result of recent investigations on the subject, I have carefully examined the "solar intensity apparatus," the indications of which form the basis of those calculations. This unique device will be found delineated on p. 267 of the work referred to, the accompanying illustration (Fig. 1) being a fac-simile of the same. It represents a longitudinal section through the centre line, thus described:—A B and C D are two concentric cylinders soldered one to the other; they form a kind of boiler, the annular space being filled with water or oil at any temperature. A thermometer, *t*, passes through a tube, across the annular space, to the axis of the cylinder; it receives the solar rays introduced through a diaphragm, *m n*, the opening, *o*, of which is very little larger than the bulb of the thermometer. A thick glass, V, closes the back part of the instrument, and admits of ascertaining whether the thermometer is placed in a direct line with the pencil of rays. The interior cylinder and the thermometer *t* are coated with lamp black. A second thermometer, *t'*, shows the temperature of the annular space, and consequently that of the inclosure. The whole apparatus is mounted on a support having a parallactic movement, to facilitate following the diurnal motion of the sun. The apparatus being exposed to the sun, it will be found, on observing the two thermometers, that their difference of temperature increases gradually, and that in a short time it ends by being constant.

Before pointing out the peculiarities of the contrivance thus described by Père Secchi, it will be instructive to examine his "solar intensity apparatus," manufactured by Casella, represented in Fig. 2. The manufacturer publishes the following statement regarding this instrument:—"Two thermometers are here kept immersed in a fluid at any temperature, and a third surrounded by the same conditions, but not immersed, is exposed to the rays of the sun. The increase of temperature thus obtained is found to be the same, irrespective of the temperature of the fluid which surrounds it." No one acquainted with the principles which govern the transmission of heat within circulating fluids can fail to observe that the thermometers applied above the central tube will not furnish a reliable indication of the temperature of the fluid below the same, nor of any portion of the contents of the annular space towards the bottom. Apart from this defect, it will be perceived that an upward current of atmospheric air will sweep the underside of the external cylinder, causing a reduction of temperature of the fluid confined in the lower half of the annular space. Again, the heat radiated by the bulb of the thermometer exposed to the sun will elevate the temperature of the air within the central tube, and consequently produce an internal circulation tending to heat the upper part of the fluid contained in the annular space. The effect of the irregular heating and cooling thus adverted to will be considered after an examination of the result of some observations recorded in Table A conducted at different times during the month of September 1871. In order to insure an accurate position, the instrument during these observations was mounted in a revolving observatory upon a table turning on declination axes provided with appropriate mechanism and declination circle. An actinometer being attached to the same table, the true intensity of the radiant heat, as well as the sun's zenith distance, were recorded simultaneously with the indications of the Secchi instrument furnished by Casella. Let us first consider the tabulated observations of September 2 recorded at equal intervals of three minutes. The indication of the two thermometers immersed in the fluid contained in the annular space first claims our attention, since the temperature of this fluid is the principal element in Père Secchi's computations of solar temperature. It will be seen on referring to the second and third columns of the table that, while the upper thermometer indicates a mean temperature of 86·9,° the lower one shows only 79·5°, difference = 7·4°. This great discrepancy of temperature at different points of the upper portions of the annular space at which, owing to the inclined position of the concentric tubes, something like uniformity ought to exist, suggests a still greater discrepancy of temperature at the underside towards the lower termination of the tubes. In addition therefore to the observed irregularity of temperature at the upper part, shown by the table, no indication whatever is furnished of the temperature of the fluid in the annular space below the central tube, nor towards the termination at either side. Obviously, then, no accurate computation can be made of the degree of refrigeration to which the central thermometer is exposed by the radiation from the cold blackened surface of the internal tube, every part of which, as we have seen, possesses a different temperature compared with the rest, consequently transmitting radiant energy of different intensity. It will be found practically impossible, therefore, to determine the true differential temperature of the contents of the bulb exposed to the sun's rays and the fluid contained in the annular space. Hence, the differential temperature entered in the table, the result of comparing the indications of the thermometers, is manifestly incorrect. It will be found also by reference to the table that while the mean temperature imparted to the central thermometer by the sun's rays is 93·1°, the mean temperature of the fluid in the annular space is 83·3°. Consequently, the intensity of solar radiation established by the instrument is only 93·1° – 83·3° = 9·79° Fah. Now, the sun during the recorded experiment of September 2 was exceptionally clear, the mean indication of the actinometer while the experiment lasted being 60·05°, thus showing that the energy developed was only $\frac{9·79}{60·05}$ = 0·16 of the true radiant intensity. The mean zenith distance, it may be mentioned, was only 33° 24′ during the experiment. Agreeable to the table of temperatures previously published, the maximum solar intensity for the stated zenith distance is 63·35°; thus we find that the sun, as stated, was exceptionally clear while the trial took place, which resulted in developing the trifling intensity of 9·79° Fah. The result of the experiments conducted September 6th, recorded in the table, it will be seen was nearly the same as that just related, the mean temperature indicated by the thermometer exposed to the sun being 98·2°, while the mean of the two thermometers immersed in the fluid was 87·8°, hence the differential temperature 98·2° – 87·8° = 10·4°. The mean temperature of solar radiation during the experiment, ascertained by the actinometer, was 59·75°, the zenith distance being 35° 33′. Consequently, the intensity indicated September 6th was only $\frac{10·45}{59·75}$ = 0·17 of the true energy of the sun's radiant heat, against 0·16 during the previous experiment. It will be observed that the fluctuation of the differential temperature was much greater September 2nd than during the succeeding experiment, owing, no doubt, to the influence of currents of air produced by a strong breeze on the first occasion, the revolving observatory being partially open on the side presented to the sun during observations.

With reference to the small differential temperature indicated by the Secchi instrument manufactured by Casella, it may be urged that it is not intended to show the true intensity of solar radiation on the earth's surface, but simply a means of determining solar temperature. Granted that such is the object, yet the extreme irregularity of the temperature of the fluid within the annular space shows that the instrument is unreliable, a fact established beyond contradiction by an experiment instituted September 27, 1871. On this occasion water of a uniform temperature was circulated through the annular space. This was effected by gradually charging this space from the top, and carrying off the waste at the bottom, holes having been drilled in the external casing for that purpose. The result of this conclusive experiment is recorded at the foot of Table A. It will be found on reference to the figures, that the mean difference of the two thermometers immersed in the fluid was only 64·9° – 64·4 = 0·5°, while the mean differential temperature was augmented to 79·1° – 64·45 = 14·65° against 9·79° on the 2nd of September, although the zenith distance was greater, and the solar intensity less; circumstances which ought to have *diminished* the indicated intensity. It is needless to enter into any further discussion of the demerits of the instrument represented in Fig. 2. We may now return to the consideration of the device delineated in Fig. 1, copied from "Le Soleil." It will be seen that the material difference of construction is that of applying only one thermometer for ascertaining the temperature of the fluid in the annular space. Possibly this single thermometer may indicate approximately the mean temperature of the upper and lower portions of the fluid above the central tube; but it furnishes no indication of the temperature below, nor at either extremity of the annular space. The inadequacy of the means adopted for ascertaining the temperature of the internal surface which radiates towards the bulb of the central thermometer having thus been pointed out, it will be well to consider whether the expedient of passing a stream of water of nearly uniform temperature through the annular space, will insure trustworthy indication. In order to determine this question, I have constructed two instruments, in strict accordance with the delineation in Fig. 1, excepting that in one of these the concentric cylinders are considerably enlarged, the annular space, however, remaining unchanged. Experiments with the two instruments prove that the enlargement does not materially influence the indications, provided water of a uniform temperature be circulated through the annular space. But these experiments have demonstrated that the size of the bulb of the thermometer exposed to the sun cannot be changed without influencing the differential temperature most materially. This will be seen by reference to Table B, which records the result of experiments with different thermometers, and tubes of different diameter, conducted October 17, 1871. As on previous occasions, the instruments, in order to insure accurate position, were attached to the declination table arranged within the revolving observatory. The bulbs of the thermometers employed were very nearly spherical, their diameters being respectively 0·30 and 0·58 ins. The upper division of Table B which records the experiment with the *small* bulb exposed to the sun, establishes, it will be seen, a differential temperature of 14·4° for the instrument having the 1¼-in. central tube, and 16° for the one having the 3-in. central tube. Referring to the lower division of the same table, it will be seen that when the thermometer with the *large* bulb is exposed to the sun, the differential temperature reaches 22·5° in the instrument containing the 1¼in. central tube, and 21·1° in the one having the 3in. tube. We thus find that, by doubling the diameter of the bulb of the thermometer exposed to the sun, all other things remaining unchanged, an augmentation of the differential temperature amounting to nearly one-third takes place. This fact proves the existence of inherent defects fatal to the device delineated in Fig. 1, rendering the same wholly unreliable.

Agreeably to the doctrine of exchanges, the diameter of the bulb is an element of no moment, since the internal radiation towards the same—*provided its temperature be uniform*—depends solely on the temperature and angular distances of the radiating points of the enclosure. Infallibility of the "solar intensity apparatus" has evidently been taken for granted on the strength of the soundness of this doctrine, as we find no allusion to the size of the bulb in M. Soret's account of his observations of solar intensity on Mont Blanc; nor does Mr. Waterston, who employed a similar instrument during his observations in India, advert to the dimensions of the bulb of the ther-

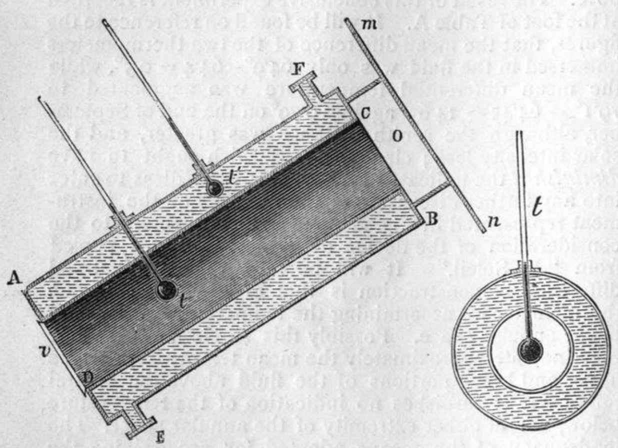


FIG. 1.

mometer exposed to the sun. These physicists apparently overlook the fact that, while the entire convex area of the bulb is exposed to what may be considered the cold radiation from the enclosure, only one half receives radiant heat from the sun. This circumstance would be unimportant if the heat thus received were instantly trans-

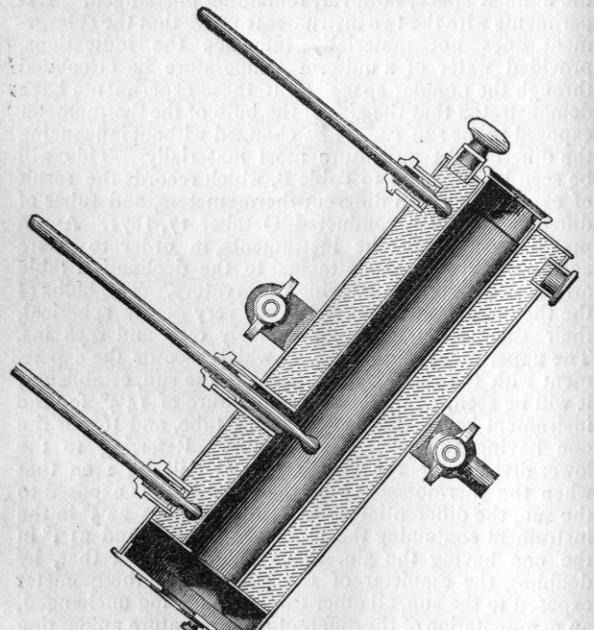


FIG. 2.

mitted to every part; but the bulb and its contents are slow conductors, while the conducting power diminishes nearly in the inverse ratio of the square of the depth. Consequently, by increasing the diameter, the parts of the bulb opposite to the sun will receive considerably less heat in a given time than if the diameter be diminished.

TABLE A, showing the result of observations made with Secchi's "Solar Intensity Apparatus," manufactured by Casella.

SEPTEMBER 2, 1871.

Thermometer exposed to the Sun.	External Casing.			Differential temperature.	Zenith distance.
	Upper Thermometer.	Lower Thermometer.	Mean.		
Fah.	Fah.	Fah.	Fah.	Fah.	° ′
83·5	76·0	70·0	73·0	10·5	33 0
84·2	77·0	71·5	74·2	10·0	
85·5	79·0	74·2	76·6	8·8	32 50
86·0	83·5	74·5	79·0	7·0	
89·0	84·0	75·5	79·7	9·2	33 0
90·5	85·0	76·5	80·7	9·2	
92·0	85·5	78·0	81·7	10·2	33 10
93·0	86·5	79·0	82·7	10·2	
94·0	87·8	80·0	83·9	10·1	33 21
94·5	89·0	81·5	85·2	9·2	
95·5	90·0	82·5	86·2	9·2	33 32
96·5	90·5	83·5	87·0	9·5	
98·0	91·5	84·5	88·0	10·0	33 44
99·0	92·0	85·0	88·5	10·5	
100·0	93·0	86·0	89·5	10·5	33 56
101·0	93·5	86·5	90·0	11·0	
101·5	94·0	87·0	90·5	11·0	34 8
93·1	86·9	79·5	83·3	9·79	33 24
SEPTEMBER 6, 1871.					
94·5	88·0	81·5	84·7	9·7	35 56
95·5	88·5	83·0	85·7	9·7	
96·5	89·5	84·5	87·0	9·5	35 41
97·5	90·0	85·0	87·5	10·0	
98·0	90·0	85·0	87·5	10·5	35 26
98·5	90·5	85·5	88·0	10·5	
99·0	90·5	85·7	88·1	10·9	35 11
100·0	91·0	86·5	88·7	11·2	
100·3	91·0	87·0	89·0	11·3	34 56
100·3	91·2	87·5	89·3	11·0	
100·5	91·5	88·0	89·7	10·8	34 41
98·2	90·2	85·3	87·8	10·45	35 33
SEPTEMBER 27, 1871.					
78·5	64·0	64·0	64·0	14·5	44 0
79·0	65·0	64·0	64·5	14·5	
79·5	65·0	64·5	64·7	14·7	44 55
79·5	63·0	65·0	64·0	15·5	
79·5	64·0	65·0	64·5	15·0	45 51
79·0	64·5	65·0	64·7	14·2	
79·0	64·5	65·5	65·0	14·0	46 48
79·0	64·5	65·5	65·0	14·0	
79·0	65·0	65·5	65·2	13·8	47 46
79·1	64·4	64·9	64·65	14·45	45 16

TABLE B, showing the result of employing different thermometers.

Diameter of Bulb 0·30 in.

1¼ inch tube.			Zenith distance.	3 inch tube.			Zenith distance
Sun.	Fluid.	Diff.		Sun.	Fluid.	Diff.	
Fah.	Fah.	Fah.	° ′	Fah.	Fah.	Fah.	° ′
74	60	14	50·32	77·5	62·1	15·4	49 54
74·5	60·3	14·2	50·24	78·5	62·3	16·2	50 3
75	60·7	14·3	50·16	79	62·5	16·5	50 12
75·5	61	14·4	50·8	79	63	16	50 21
76	61	15	50·1	79	63	16	50 30
75·0	60·6	14·4	50·16	78·6	62·6	16·0	50 12

Diameter of Bulb 0·58 in.

1¼ inch tube.			Zenith distance.	3 inch tube.			Zenith distance
Sun.	Fluid.	Diff.		Sun.	Fluid.	Diff.	
Fah.	Fah.	Fah.	° ′	Fah.	Fah.	Fah.	° ′
83·6	62·6	21	49 54	79·2	60·1	19·1	50 32
85·5	63	22·5	50 3	81	60·3	20·7	50 24
86·4	63·4	23	50 12	82·5	60·7	21·8	50 16
86·7	63·5	23·2	50 21	82·7	60·7	22	50 8
87·7	63·7	23	50 30	83	61	22	50 1
85·9	63·2	22·5	50 12	81·7	60·6	21·1	50 16

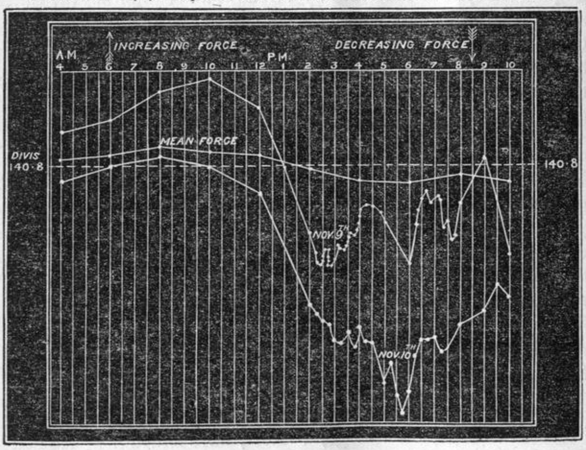
J. ERICSSON

MAGNETICAL AND METEOROLOGICAL OBSERVATIONS AT HAVANA

On the 9th and 10th day of November I noticed on my instruments two strong magnetic perturbations, during which a series of extraordinary observations was taken at intervals of five, of ten, and fifteen minutes. From these I was naturally drawn to think that an aurora borealis would be seen in higher latitudes, and was waiting for a confirmation of my views.

This I found in the numbers 16th and 23rd of November of your scientific journal, NATURE, which I have just received, and in which I see with great pleasure the description of the aurora borealis seen in England on the 9th and 10th of November in perfect accordance with my observations of those days.

Curves of the Horizontal Magnetic Force on the 9th and 10th days of November, 1871, compared with the Mean Force of the whole month.



SCALE { *1 hour* = 0^m ·01 *in the line of the abscissæ*
5 division of the scale of the Bifilar Magnetometer = 0^m ·01 *in the line of the ordinates.* }

Each one of these divisions of the scale corresponds in parts of horizontal force to K = 0·000099573.

As it will not be devoid of interest to know to what an extent an aurora borealis, when seen in England, exerts its influence on the magnetic variations of a place situated in the Tropics and in very remote longitude, I take the liberty of sending you the curves of the horizontal magnetic force as registered by the bifilar magnetometer on the 9th and 10th of November, together with the curve of the mean horizontal force of the whole month. A comparison between them and those taken in other places will be, I hope, very pleasant to those who are interested in magnetic researches.

My observations on the bifilar magnetometer are reduced to the temperature of 77° Fah. The variation of the thermometer attached to it was 0°·8 during the whole perturbation.

The magnetic instruments I make use of are those of the Observatory of Makerston, Scotland, which were arranged and sent many years ago to this Observatory by order of General Sabine at the request of P. Secchi, of the Roman Observatory.

Another perturbation, although not so intense as those already described, was observed on the 2nd of November. It began at ten o'clock in the morning, and lasted the whole day.

A very remarkable one was also observed on the 17th and 18th of June; it began at ten o'clock in the evening of the 17th.

On the 21st of August, while a hurricane was felt in St. Thomas, and an aurora borealis seen from the Observatory of Dun Echt, Aberdeen, I noticed an extraordinary variation, which attained its maximum between four and six o'clock in the afternoon. A similar one occurred on the 24th.

Finally, on the 16th and 17th of August two great hurricanes swept the shores of Florida, and their influence upon the magnetic force can be perfectly noticed on the curves of those days.

BENEDICT VINES

Havana, Dec. 21, 1871

NOTES

WE alluded some time since to the threatened destruction of one of the most notable megalithic monuments in this country, the Great Circle at Avebury, in Wiltshire. All archæologists will be glad to hear that Sir John Lubbock has added one more to his eminent services to science by the purchase of the site on which the Circle stands. It is right also that the meed of praise should be awarded to those of the residents in the district whose zeal has been directed towards the attainment of this object, and who have thus shown their sense of the value of the monument which is one of the glories of their county. We refer especially to the Rev. Bryan King, the vicar of the parish, Mr. Kemm, Mr. George Brown, and the Rev. Alfred Charles Smith, Hon. Secretary of the Wiltshire Archæological and Natural History Society. It is to be hoped that their example will stimulate similar zeal for the preservation of monuments in other parts of the country.

DR. T. STERRY HUNT, chemist to the Canadian Geological Survey, has been appointed to the chair of Geology in the Massachusetts Institute of Technology.

MR. HENSMAN has been appointed Lecturer on Botany at the Middlesex Hospital, in the place of Dr. T. S. Cobbold, F.R.S., who has received the appointment of Lecturer on Parasitic Diseases.

AT the meeting of the Royal Geographical Society on Monday evening last, Sir Henry Rawlinson, the President, announced that the vessel with the Livingstone Expedition on board arrived at Malta on the 23rd inst., and was to reach Port Said on Sunday, and leave Suez on Monday night. By the accounts to hand all on board were pronounced to be well, and in the highest spirits. The finances of the expedition were in a highly satisfactory state, many contributions being remarkably striking, as showing the great interest taken in the enterprise not only in this, but in many distant countries. A contribution of 100 guineas had been received from a former member at Stockholm, who had always taken a deep interest in the travels and discoveries of Dr. Livingstone. The Italian Royal Geographical Society had also sent a contribution of 15*l.* 15*s.*, while national committees to assist the fund had been formed in Scotland and Ireland, who were working most energetically. The town of Glasgow has subscribed 1,000*l.*, Edinburgh 400*l.*, and Dublin promised to be equally generous. Similar interest had been awakened in Chicago, whence 100*l.* had come in to be placed at the disposal of the Livingstone Expedition; and on the whole it might be said the announcement of the undertaking had been hailed with general satisfaction throughout the civilised world. Exclusive of two sums of 400*l.* and 600*l.* odd, the latter the balance of the former Government grant, there was now standing to the credit of the expedition a sum of 4,200*l.*

THE following gentlemen were on Saturday last elected to Junior Studentships in Natural Science at Christchurch, Oxford:—Mr. D. A. Greswell, Commoner of Balliol College, Mr. B. Hainsworth, of Manchester Grammar School, Mr. W. A. Smith, of Clifton College. These scholarships are of the annual value of 75*l.*, together with the rooms rent free.

AT the examination recently concluded at the Melbourne University, there were no less than 225 competitors, of whom 86 passed the matriculation examination, and 108 the civil service examination. Many of the names in the former were included in the latter, but on the other hand, there were some who passed the larger, the matriculation examination, who did not pass the smaller examination, that for the civil service. The reason is, that for the matriculation any six subjects serve to qualify, while for the civil service, of the four subjects, two given ones are essential. The examinations this time had a novel feature, from there being three lady candidates, all of whom passed. The Council of the University, however, has passed a resolution to the effect that the successful ladies should not be allowed to matriculate. No reasons have been given for this decision, but it is presumed that the obstacle is a legal one.

THE *Academy* states that the President of the Geographical Society of Italy has written to the papers to say that the Conservator of the Bibliothèque Royale of Belgium has discovered a MS., in twelve chapters, containing the original autograph account of the discovery of Australia by Manuel Godinho, a Portuguese navigator, who touched there in 1601, and whose priority to the Dutch sailors, who arrived three or four years later, has been unduly neglected. Mr. Ruelens vouches for the authenticity of the MS., which was brought to light at the Antwerp Exhibition, though it passed unnoticed in the crowd.

PROF. CLEVELAND ABBE, in an article entitled "Historical Note on the Method of Least Squares," in the American Journal of Science and Arts, shows that this method, though first published in a printed form by Le Gendre in 1806, and invented by Gauss in 1795, was published in 1808 by Prof. Robert Adrain, at that time in New Brunswick, N. J., in the "Analyst," he having been independently led to this invention by the study of a prize problem offered some months previously in that periodical.

AN important addition has been made to the list of works devoted to inquiries and instructions in regard to the great fisheries in the form of a paper, by M. Achille Costa, upon the fisheries of the Gulf of Naples, published by the Royal Institute for the Encouragement of Natural Science, &c., of Naples. The subject is treated under four heads: first, a description of the various modes by which fishing is prosecuted in the Gulf of Naples, whether commendable or otherwise, with engravings of the nets and other apparatus used; second, the consideration of the various modes of fishing, and their relationship to the present and prospective supply; third, memoranda in regard to the localities in which the different kinds of fish and other marine animals are to be found, and the favourite places for depositing their spawn; and fourth, a systematic catalogue of the different species of marine animals found in the Gulf of Naples, and gathered for the purpose of serving as food.

PROF. MARSH reports to the *American Journal of Science* the discovery, during his explorations in 1871, of a remarkable fossil bird. It was found in the Upper Cretaceous of Western Kansas, and the remains consist of the greater portion of the skeleton, at least five feet in height, and which, although a true bird, as is shown by the vertebræ and other parts of the skeleton, differs widely from any known recent or extinct forms of that class, and affords a fine example of a comprehensive type. The bones are all well preserved. The femur is very short, but the other portions of the legs are quite elongated. The metatarsal bones appear to have been separated. On his return the professor proposes to describe this unique fossil under the name of *Hesperornis regalis.*

IN the expedition against the Losshais, who have attacked our tea plantations in Cachar, the interests of science have been cared for. Lieutenant Browne, 44th Foot, known in India as an able naturalist, has charge, with a trained native from the Indian Museum at Calcutta, to act as collector. Something is expected from the unexplored regions of the Losshai country.

HERR PAUSCH, a member of the late German polra expedition, recently made a communication to the German Anthropological Society in regard to certain abandoned habitations of the Esquimaux in East Greenland. He remarked that at each of seven different points they found three stone houses, some of them certainly over one hundred years old. These were winter huts, the remnants of their summer abodes being indicated by stone rings. In many places there were indications of stone graves, and from the skeletons found in them tolerably well-preserved crania were obtained, agreeing with the Eastern Esquimaux type as described by Virchow, and exhibiting the carnivorous habit in the highest degree. Remains of wood carving, tolerably well executed, occurred with the dead bodies, and in the heap were found bone knife-handles, harpoons of bone, arrow-tips, and even knife-shaped pieces of iron, probably obtained from the English expedition of 1823.

IN referring to the explorations of Dr. Hayden about the Yellow Stone Lake during the past summer, mention was made of the fact that the trout all seemed very much infested with a peculiar kind of worm, which interfered considerably with the enjoyment of eating them. Specimens of this animal have been submitted to Prof. Leidy, of Philadelphia, who reports that they represent a new species or type of worm, of the genus *Dibothrium.* Two species of the genus have long been known as infesting salmon and other members of the trout family in Europe, but both are decidedly different from the new form just mentioned.

THE Trustees of the Museum of Comparative Zoology at Harvard College, Cambridge, U.S.A., have issued their Annual Register for 1870, together with the Report of the Director, Prof. Agassiz. It is stated that the accessions to the Museum during the past year had been very great and of surpassing importance. Foremost stands Deyrolle's collection of Curculionidæ, presented by Mrs. A. Hemenway; next the collection of Galls of Baron d'Osten-Sacken, presented by him; then the magnificent collection of Fossil Plants of M. Lesquereux, especially remarkable for the exquisite selection of the specimens it contains, and that of Insects of Texas, made by Mr. J. Boll, both of which have been bought by the Museum; and not least the unparalleled collection of Neuroptera, brought to America by Dr. Hagen, and now deposited in the Museum. There are special reports on the Mammalia and Birds by Mr. J. A. Allen; on the Fishes by Dr. Franz Steindachner; on Conchology by J. G. Anthony; on the Articulata by Dr. Hagen; and on the Palæontological collections by Prof. Shaler, Mr. J. B. Perry, and Dr. G. A. Macak.

WE have received the Register of the Trustees, Officers, and Students of the Lehigh University, South Bethlehem, Penn., U.S., for the year 1871-72. The University was founded by a gift, in the year 1865, from the Hon. Asa Parker, of the sum of 500,000 dols., and a site of land containing 56 acres in the Lehigh Valley. The purpose of the founder was "to provide the means for imparting to young men of the valley, of the state, and of the country, a complete professional education, which should not only supply their general wants, but also fit them to take an immediate and active part in the practical and professional duties of the time. The system determined upon proposes to discard only what has been proved to be useless in the former systems, and to introduce those important branches which have been heretofore more or less neglected in what purports to be a liberal education, and especially those industrial pursuits which tend to develop the resources of the country,—pursuits, the paramount claims and inter-relations of which natural science is daily displaying—such as Engineering, Civil, Mechanical, and Mining; Chemistry, Metallurgy, Architecture, and Construction." For this purpose, special classes in all the above-named subjects have been instituted; and by the liberality of Robert H. Sayre, one of the trustees of the University, an Astronomical Observatory has been erected in the University grounds and placed under the care of the Professor of Mathematics and Astronomy, for instruction of students in Practical Astronomy. The Observatory contains an equatorial, by Alvan Clark, of six inches clear aperture, and of eight feet focus; a zenith sector, by Blunt; a superior astronomical clock, by William Bond and Sons; a meridian circle and a prismatic sectant, by Pistor and Martins.

DR. E. ASKENASY, in his "Beiträge zur Kritik der Darwinschen Lehre," contrasts the doctrine of Natural Selection as carried out to its full extent by Darwin in his "Origin of Species" and "Variation of Animals and Plants under Domestication," with the modified form of theory adopted by Nägeli in his "Conception and Origin of Species in Natural History."

THE first part of Dr. N. J. C. Müller's "Botanische Untersuchungen" treats of the separation of carbonic acid by the green parts of plants under the influence of sunlight, and is illustrated by a plate, delineating, in the form of curves, the effects of the different rays in the solar spectrum.

DR. GERARD KREFFT, in a paper on the Australian Vertebrata, Fossil and Recent, points out how valuable would be a general study of Natural History in a country like Australia, where every pool and creek teems with animal life, numerous mussels, various kinds of cray-fish, turtles, frogs, lizards, freshwater snakes, and other creatures, all of which are more nourishing to a starving human being than the wretched nardoo on which the lamented Burke and Wills tried to subsist. He advocates the establishment of district museums, and that the children should be taught to observe the habits and economy of different animals, in particular of those which are useful, by which means the wealth of the country would be much increased. Dr. Krefft promises hereafter a complete natural history of Australian Vertebrates, which will be the first ever published.

THE "American Horological Journal," published in New York, of which several numbers lie on our table, contains not only articles of special interest to manufacturers and vendors of clocks and watches, but others on Spectrum Analysis, and kindred scientific subjects.

"INDEX TO PRICES" is responsible for the following:—The demand for human hair is so great that it is impossible to supply it. Price has risen to 16*s.* a pound. As much as 1,000 dols. has been offered for a "head of hair" six feet long. Some ladies dress fifty to sixty miles of hair every morning.

AT the meeting of the Society of Arts held last week, Dr. Brands, Inspector-General of Forests to the Government of India, said that the cinchona plantations were now become almost forests. Before long they would be able to be coppiced every six or eight years, just as oak coppices were treated in Germany, Scotland, and elsewhere, every fifteenth or eighteenth year, and this would probably be the simplest and most profitable mode of getting the bark. The introduction of ipecacuanha into India was also alluded to. Dr. Masters expressed an opinion that there must be dozens, if not scores, of plants indigenous to that country, having the same medical properties as ipecacuanha, which could be much more easily utilised.

ACCORDING to the editor of the *Journal of Conchology*, of Paris, the Paris Museum received twenty-three shots from cannon of the German besiegers in the course of the siege, destroying many of the plant-houses. Two of these balls exploded in the conchological laboratory, in the care of Prof. Deshayes, causing great injury to the specimens, and the *Septaria* in the general collection were literally ground to powder. The large collection of shells of the lower sands of the Paris basin was entirely destroyed. This is much to be lamented in a scientific point of view, as it contained many types. A ball also passed through a glass case containing the Unios and Anodonta.

AT a late meeting of the State Dental Society of Pennsylvania one of the members, Dr. Barker, is reported in the *Dental Times* (July 1871) to have read an essay on Irregularity of Teeth, the circumstances favouring it, and suggestions on its prevention and treatment. The essayist held the opinion that a retrograde metamorphosis is going on in human teeth. To obviate this there must be improvement in the mode of living, the use of more substantial food, and from the time of the appearance of the deciduous teeth children should be under the care of an educated dentist; so that when the permanent teeth begin to erupt they may be properly guided, and a regular arch result. As a rule the first permanent molars should be extracted to make room for the succeeding teeth, for the jaws of the Anglo-Saxon race are shortening, and no longer have room for thirty-two teeth. How will this end?

ON January 28, the town of Schamachi, in the Caucasus, was totally destroyed by a succession of earthquakes. Few houses remain standing, and many lives have been lost.

A CORRESPONDENT of the *Globe* writes to say that the recent intelligence, describing the total destruction of the city of Oran in Chilé by an earthquake, must be a mistake. He says, that the city of Oran in the province of Salta, in the Argentine Confederation, was destroyed by an earthquake, on October 22, last year, but very few lives were lost. This is the earthquake referred to in NATURE (p. 251), but the date was there wrongly given as November 15.

BETWEEN ten and eleven at night, on December 12, two shocks of earthquake were felt at Serampore, in quick succession. The second and the strongest lasted about ten seconds, and seemed to move from north to south. The vibrations were very strong, but no great amount of damage was done.

THE Rangoon Mail states that on the night of December 12, an earthquake which lasted about ten seconds was felt at Prome. The wave appeared to travel from north-east to south-west. The shocks were stated to be severe, and followed in quick succession, but no damage is reported in the town. The earthquake occurred on the night of the new moon. A letter received from Herzadak states that an earthquake was felt there on the same night. In another paragraph we give an account of an earthquake felt at the same time at Serampore.

ON the 12th of December at 10.5 P.M. an earthquake was felt at Calcutta with a shock lasting eight seconds, and moving from east to west. It was felt at Ducca about the same time, but its direction was considered to be from north to south. It was also felt at Akyab and in Burmah.

WALLACE ON THE ORIGIN OF INSECTS*

AMID all the discussions to which the question of the Origin of Insects has given rise, it is to me surprising that one of the most ingenious and remarkable theories ever put forth on a question of natural history has not been so much as once alluded to. More than six years ago, Mr. Herbert Spencer published, in his "Principles of Biology," a view of the nature and origin of the annulose type of animals, which goes to the very root of the whole question; and, if this view is a sound one, it must so materially affect the interpretation of all embryological and anatomical facts bearing on this great subject, that those who work in ignorance of it can hardly hope to arrive at true results. I propose, therefore, to lay before you a brief sketch of Mr. Spencer's theory, with the hope of calling attention to it, and inducing some of you to take up what seems to me to be a most promising line of research; and, although the question is one on which I feel quite incompetent to form a sound judgment, I shall call your attention to the light which it seems to throw on some of the most curious anomalies of insect structure.

The theory itself may be enunciated in very few words. It is, that insects, as well as all the Annulosa, are not primarily single individuals, but that each one is a compound, representing as many individuals as there are true segments in the body, these individuals having become severally differentiated and specialised to perform certain definite functions for the good of the whole compound animal.

Mr. Spencer first calls attention to the fact, that among the undoubtedly compound animals (which are almost all found in the sub-kingdoms, Cœlenterata and Molluscoida) the several individuals are rarely combined in such a manner as to necessitate any physiological division of labour amoug them. The associated individuals of a Hydrozoon or an Ascidian are each free to spread their tentacles, to draw in currents of water, and to select their food, without in any way interfering with each other, because the compound animal is either branched or approximately hemispherical, and thus there is no necessity for any of the combined individuals to become especially modified with regard to the rest. But should a compound animal have its component individuals arranged in a linear series, there would most probably arise a marked difference of conditions between the two situated at the extremities and those between them. If they remained united, some modification must have occurred to adapt each to its condition. But if, further, the series should be fixed at one end, the other being free, a new differentiation must arise; for the two ends being very differently situated, the intermediate ones will also differ accordingly as they are nearer one end or the other. Here there is a cause for the differentiation of united individuals that does not exist in any branched or other symmetrical arrangement than a linear one. Some of the Salpidæ show such a rudimentary linear aggregation, but their mouths and vents being lateral the individuals are so similarly situated that no differentiation need occur. A little consideration will show us that this is one of those cases in which perfectly transitional forms are not to be expected. A permanent union of individuals in a linear series, such as to necessitate differentiation of function among them, could only be effected by a series of co-ordinated gradations, each of which would have so great an advantage over its predecessor as to necessitate its extinction in the struggle for existence. We cannot expect to find the union without the differentiation, or the differentiation without the complete union; and it will, therefore, be impossible to prove that such was the origin of any group of animals, except by showing that numerous traces of separate individualities occur in their organisation, and cannot be explained by any of the known laws of development or growth in animals not so compounded.

In the structure of the lower Annelids we do find strong indications of such an ancestral fusion of distinct individuals. These animals are composed of segments, not merely superficial, but exhibiting throughout a wonderful identity of form and structure. Each segment has its branchiæ, its enlargement of the alimentary canal, its contractile dilatation of the great blood-vessel, its ganglia, its branches from the nervous and vascular trunks, its organs of reproduction, its locomotive appendages, and, sometimes, even its pair of eyes. Thus every segment is a physiological whole, having all the organs essential to life and multiplication. Again, just as other compound animals increase by gemmation or fission, so do these. The embryo leaves the egg a globular ciliated gemmule; elongation and segmentation then take place, always in the hinder part, so as to elongate the compound animal without interfering with the more specialised anterior segment. In the Nemertidæ, and some Planaria, spontaneous fission occurs, each part becoming a perfect animal, and in the Tænia this is the usual mode of reproduction. The account given by Professor Owen in his "Comparative Anatomy of Invertebrates" is very suggestive of Mr. Spencer's view. He says:—"On the first appearance of the embryo annelid it usually consists of a single segment, which is chiefly occupied by a large mass of unmetamorphosed germ-cells. And these are not used up, as in higher animals, in developing the tissues and organs of an undivided or individual whole, but, after a comparatively slight growth and change of the primary segment, proceed in the typical orders to form a second segment of somewhat simpler structure, and then repeat such formations in a linear series, perhaps more than a hundred times. So that we may have a seeming individual annelid, consisting of many hundred segments, in which a single segment would give all the characteristic organisation of such individual, except some slight additions or modifications, characterising the first and last of the series." He also tells us that spontaneous fission has now been observed to take place in almost every order of Annulata; and, in many, artificial fission produces two distinct individuals. In some cases the compound animal consists of very few segments, three only in the genus Chætogaster, the fourth always separating as a zooid, and forming a new animal. In the higher Articulata, the process of gemmation goes on to a considerable extent in the egg, and even afterwards in some cases, but more or less irregularly. Thus the larva of Iulus is hatched with eight segments, and at the first moult it acquires six new ones, which are added between the last and the penultimate.

The gradual fusion of the once distinct individuals into a complete unity, is shown in a very interesting manner as we advance from the lower to the higher forms. In the Annelida, Dr. Carpenter tells us, the spiracles of each segment are separate, and do not communicate internally with those of other segments. In the Myriapoda they partially communicate, while in the Insecta they communicate perfectly by a system of anastomosing vessels. The same thing is indicated by the various positions of the chief spiracles. In Smynthurus among the Poduridæ there are only two, opening under the side of the head immediately beneath the antennæ. In Solpugidæ (Arachnida) they are situated between the anterior feet; in some spiders they open near the end of the abdomen, in others at its base. The position of the mouth and eyes at the anterior extremity of the body, and the vent at the posterior, are obviously what would arise as soon as any specialisation of function in the series of zooids occurred. It is not, therefore, surprising that we never find these change their position. But for the respiratory and generative organs there is no such necessity for fixity of position, and as *they* existed originally in every segment, we can well conceive how, as articulate forms become more and more modified, it would sometimes be useful to the compound animal for these organs to become abortive or developed in different parts of the body. We have seen that this is to some extent the case with the former organs, but it occurs to a much greater extent with the latter.

The most generalised form is to be seen in the intestinal worms, each segment of which possesses a complete hermaphrodite reproductive apparatus; so that, in this respect, no less than in their capacity for spontaneous fission, these creatures are really what we should expect the early type of compound animals to be. This, however, is a rare case, but even in the much higher leeches there are testes in no less than nine of the segments, and Dr. Williams discovered a direct passage from the spermatheca to the ovaries, which seems to indicate internal self-fertilisation. It is, however, in the lower Arthropoda that we find the most curious diversities in the position of these organs. In the Glomeridæ the genital openings in both sexes are situated in the third segment, just behind the insertion of the second pair of limbs. In the Polydesmidæ the female organs are in the third segment, while those of the male are in the seventh segment. In Iulus the same organs are situated in the fourth and seventh segments respectively. The Chilopoda, on the other hand, have them near the end of the body, as in most insects. In the Acarina the ovaries open on the middle of the abdomen or on the under side of the thorax, either between or behind the last pair of legs. In spiders the seminal orifice is at the base of the abdomen, but the palpi are the intromittent

* Extracted from an Address read at the Anniversary Meeting of the Entomological Society of London on the 22nd January, 1872, by Alfred R. Wallace, F.L.S., F.Z.S., President, &c.

organs; these are spoon-shaped, and are besides armed with horny processes, hooks, and other appendages, and must be looked upon as true generative organs. In the Astacidæ the sexual organs of the male are at the base of the first pair of abdominal legs, those of the female at the base of the third pair. Among the true winged-insects there is one remarkable case of abnormal position of these organs, in the dragon flies, which have the seminal vessels in the ninth, while the complex male sexual organs are situated in the second, abdominal segment. It is interesting to note that this curious anomaly occurs in an order which is considered to be of the greatest antiquity and most generalised type among the true insects.

There are many other facts of a similar character to those I have now touched upon, and they all become clearly intelligible on the theory of Mr. Spencer, that the Annulosa are really compound animals, or, as he expresses it, "aggregates of the third order;" while the other great groups of highly organised animals—Mollusca and Vertebrata—are typically simple animals, or "aggregates of the second order," (the cells of which their structures are built up being "aggregates of the first order"). Nothing of a similar character is to be found among the two latter groups. No molluscous or vertebrate animal can be divided transversely so that the separate segments shall be in any degree alike, and contain repetitions of any important organs. The distinct separation of parts in the vertebral column has been acquired, for it is less visible in the lower types than in the higher (the reverse of what obtains among insects), and in the lowest of all is quite absent; while in none is there any corresponding multiplicity or displacement of respiratory, circulatory, or generative organs. The vertebral column corresponds rather to the segmented shell of the Chiton, and has no more relation than it to the essential plan of the more important vital organs. Neither does any mollusk or vertebrate undergo spontaneous fission, nor that complete and progressive segmentation in the process of development which is characteristic of all Annulosa; nor do they ever exhibit the phenomena of parthenogenesis or alternation of generations, the essential feature of both which is, that numerous individuals are produced from a single fertilised ovum, by a process analogous to (or perhaps identical with) ordinary gemmation, and both which phenomena sometimes occur even among the higher insects.

In concluding this short sketch of a remarkable theory, I would observe, that if it is a true one it at once invests the objects of our study with a new and exceptional interest; because they are the most highly developed portion of a group of animals which will, in that case, differ fundamentally in their plan of structure from all other highly organised forms of life. In the study of the habits, instincts, and whole economy of insects, we shall have to keep ever in view the conception of a number of individualities fused into one, yet perhaps retaining some separateness of mental action, a conception which may throw light on many an obscure problem, and which will perhaps materially influence our ideas as to the nature of life itself. We must remember also, that if the insect is really a compound animal, then the only true homology that can exist between it and a vertebrate, or a mollusk, will be one between a single segment and an entire animal, and the search after any other will be so much lost time. Especially must the acceptance of this theory have an important bearing on all embryological and genetical studies; and if the facts and arguments adduced by its learned and philosophical author do make out even a *primâ facie* case in its favour, it must deserve the careful and unbiassed consideration of all who endeavour to solve the problem of the Origin of Insects.

THE AUSTRALIAN ECLIPSE EXPEDITION

WE have already announced that no scientific results are to be expected from the Australian Eclipse Expedition, owing to the unpropitious state of the weather. The following particulars are obtained from the *Melbourne Argus*:—

"The five days intervening between the arrival at No. VI. Island and the eclipse were employed by the astronomical party in erecting and testing the instruments. Tents had to be put up, brick foundations and pedestals built, and distances determined. There was plenty of hard work, and the time at the disposal of the astronomers was found to be none too much. Nor were those who had to sleep on shore with the instruments to be envied. Possession of the island was hotly disputed by legions of rats, who behaved in the most impudent manner. They boldly eyed the operations in the daytime, winking wickedly from behind the tufts of grass. Every night they held a corroboree in the tents, coursing over the instruments and the forms of the wearied sleepers, gnawing hats and any baggage which promised a toothsome morsel; and in some instances they had the audacity to bite the men who attempted to brush them away. The passengers filled up the interval by visits to the mainland, and one or two of the neighbouring reefs and islets. On Thursday, December 8, Mr. Moore formed a party and went to Cape Sidmouth, the boat carrying provisions for three or four days. A native on the beach seemed much alarmed at their approach. When they landed he ran off at full speed and was not seen again. Only two other blackfellows showed themselves, though the tracks and camp fires proved that there were many in the neighbourhood. These blacks were known to be hostile, and it was necessary to take precautions to guard against a surprise. The master of the schooner *Challenge*, from Sydney, bound for Cape York, passed with his vessel a few yards astern of the *Governor Blackall* that morning. On hearing that a party had set out with the intention of landing at Cape Sidmouth, he expressed the consoling opinion that if they entered the bush they would never come out of it again. But no such disaster befel.

"On the hills, which rose abruptly a few hundred yards from the beach, were well-defined quartz reefs, and the neighbourhood presented all the appearance of auriferous country. A few miles from Cape Sidmouth was found an enormous heap of the bones of the dugong, the strange mammal which inhabits these seas. There were nearly two tons of bones, piled up in fantastic array, with all the skulls on top. At every turn were ant-hills, rising in solid cones from 6 ft. to 12 ft. high, and almost as hard as granite. Some of them had fine pinnacles, and these airy minarets, clustered together in graceful shapes, had a very pleasing effect. The numerous screw pines were also an agreeable feature in the landscape. The mountains, eight or ten miles inland, were well wooded, with occasional abrupt squares of grassed land.

"Mr. Moore prosecuted his botanical researches on the mainland during two days. Those who understand botany may be interested to learn from his account that the high ground at the cape is sparsely covered with stunted growths and trees, chiefly *Eucalypti* and *Grevillea chrysantha*. Advancing into the interior, broad-leaved acacias and arborescent species of *Hakea* and *Melaleuca* principally characterise the open forest country. There are belts of thick jungle scrub of no great width, in which a very slender and graceful palm, which is believed to be new, occurs in great abundance. A species of *Nepenthes*, or pitcher plant, is also found in great profusion. Araliaceous trees are numerous. Ferns are scarce, but in the open forest the ground is thickly covered with *Schizæa dichotoma*. A very remarkable plant was found as an undergrowth in this, having large white bracts and bright green foliage. It is supposed to be a species of *Mussænda*. Toward the north of the cape is a long, low, flat country, chiefly covered with mangrove. The sandy patches contain a variety of undershrubs and climbers, with a tree here and there. The silk-cotton plant (*Cochlospermum gossypium*) also varies the scene with its delicate flower. Among these shrubs a very interesting plant—a species of *Eugenia*—was found. It bears a fruit about the size and colour of a cherry, having a pleasant sub-acid flavour. This fruit was largely eaten by the party, and the tree which bears it is supposed to be well worthy of cultivation. The vegetation is otherwise principally characterised by a species of *Busbeckia*, *Elæodendron*, *Hibiscus*, *Bauhinia*, and a species of *Banksia*. After leaving the mainland the party visited No. VII. Island of the Claremont group, where Mr. Brazier added an *Auricula* and a *Bulimus* to his previous collection of shells, which included specimens of the genera *Diplommatina*, *Pupa*, *Helicarion*, *Helix*, *Truncatella*, *Pythia*, and *Cassidula*. Had the expedition selected a portion of the mainland for the observing point, there would have been some interesting and extensive explorations in the interior. The party were fully equipped with arms and ammunition, some supplied by the Government and some privately owned, but with the ship nine miles off, and the limited time at our disposal, much exploration was impracticable. In any case, there was no anchorage for the vessel within two miles of the shore, and that was one of the reasons why the island was preferred for the observatory.

"On Thursday afternoon, some of the excursionists went in the captain's boat to look for shells on a small sandbank which had come into view, and landed on an island considerably smaller than the fish that Sindbad mistook for *terra firma*. It was intended to visit No. VII. Island, but it seemed that the country we were in search of had gone under water—its custom in the afternoon—and we sailed over part of it. On Friday a visit was paid to the reef, which extends for three or four miles from one extremity of No. VI. Island. The party landed on a patch of sand, and waded about three miles in 2 ft. of water over a coral bottom, in quest of shells. Here we had the wonders of the deep and its strange inhabitants laid at our feet in all their rich variety of colour. Some curious specimens were obtained. There were enormous clams, capable of holding a man's foot in their grip, abundance of *bêche-le-mer*, pearl oysters, all kinds of star fish (some of the most beautiful ultramarine), and many sorts of coral. One member of the party picked up a handsome live conch shell, weighing about 14 lb. Another was delighted with a strange creature belonging to the star fish order. When first taken from the water it had all the appearance of a pentagonal plum cake of about 2 lb. weight, beautifully encrusted with sugar crystals and profusely ornamented with coloured caraways. But removed from the sea water the glories of this appetising-looking creature only survived a brief period. When we had been a couple of hours prospecting on this rocky bottom of the ocean the tide rose rapidly, and we had no sooner got into the boat than the whole reef dropped out of view. The attractions of No. VI. Island proper were exhausted for the majority of people in a very brief space, but one or two were sometimes to be seen meandering along the beach, the very pictures of placid contentment. The presence of a porter bottle in one hand and an oyster knife in the other seemed to suggest that they had been visiting some of the oyster beds. They were so full of blessed condition that conversation was superfluous, and on these occasions we passed them without making a remark to disturb their dreamy happiness.

"Repeated attempts had been made since leaving Sydney to catch fish, but without success, only one small one having been hooked. This afternoon, however, great sport was afforded by the sharks. The bathers who went over the ship's side every morning had been warned that there were several of these villanous footpads of the sea about; but nothing but the sight of these rapacious monsters on deck sufficed to induce them to abandon the practice. The method adopted in catching these sharks enabled both anglers and riflemen to take a part. As soon as a shark was hooked his head was drawn about six inches out of water, and three or four conical balls lodged in that ugly flat prominence settled him before he was hauled on deck to be drawn and quartered. In this way six, measuring from 9ft. to 12ft. in length, were disposed of in the course of an hour and a half, besides two which were shot in the sea, and turned over on their backs to sink. After this experience the morning ablutions of the company were limited to splashing about the decks under the hose.

"Most of the company slept through the night on deck. With the marvels of the stellar firmament above, whichever way the eye was directed, we became contemplative astronomers, like the Chaldean shepherds of old. The striking garnitude of the sky formed an endless scene to gaze at and admire. Little wonder that the ancients made the heavenly bodies objects of religious veneration. When the sun had finished his daily round, we watched the lesser light that rules the night, making her stately procession through the heavens, and the infinite variety of stars moving in concert through boundless space. There is much of the charm of romance in the study of the science which teaches us that there are other globes, in comparison with which the earth is but a speck, and proves to us that the 'patines of bright gold' with which the sky is inlaid are not simply points of light, but worlds like our own, with systems of satellites moving in their appointed courses in obedience to the laws of nature. These unknown countries afford abundant scope for interesting speculation. The mind endeavours to picture the circumstances of their inhabitants, and to conjecture, by some earthly standard, what their pursuits may be. But the imagination refuses to believe that the occupants of these bright worlds are subject to the conditions which bind those who dwell upon 'the dim spot which men call earth,' and that they have cities like ours, with their sins and their sorrows. There were some stars in the firmament which old residents of Australia had not seen for many years. While our vessel was progressing northwards, constellations unknown in the south had been coming into view, and we saw Cassiopeia and Perseus gradually rise above the horizon with great brilliancy. Apart from the scenery of the heavens, the sea was beautifully phosphorescent. When the phosphorescence was stirred all the sparks were converted by the action of the retina into lines of light, which played around the ship in radial streamers.

"No time was lost by the astronomical party when they had once effected a landing on Eclipse Island, as we christened the point of observation. The islet was soon converted into a bustling little canvas town. From nearly every tent some instrument peered, all pointing in the one direction, as though these mortals, with their puny optics, thought to stare out of countenance the great Eye of Day. The Victorian party had two analysing spectroscopes and an integrating spectroscope, both equatorially mounted. The first was in the hands of Mr. Ellery, and the second was to be worked by Mr. Foord, both gentlemen having assistants to use the finding telescopes attached to pick out portions of the corona for examination. The two analysing spectroscopes were for examining the nature of the light of the chromosphere and the corona; and the integrating spectroscope, entrusted to Mr. M'George, was designed to examine the nature of the whole light, all the observations being directed with a view to determining the character of the orb from which the light proceeds. Prof. Wilson had two Savart's polariscopes. The object of polariscopic observations is to ascertain whether the light of the corona is that of a self-luminous body or a reflected light; also, in the case of its being a reflected light, to determine the angle of incidence, the great question to be settled being whether the corona is an appendage of the sun, or whether it exists in our atmosphere. There was also a magnetic theodolite to record magnetic disturbances. Mr. Moerlin, assisted by Mr. Walter, had charge of the photographic department. The principal instrument was one of Dalmeyer's rapid rectilinear lenses of 4in. aperture and 30in. focal length, giving an image of about three-tenths of an inch in diameter, equatorially mounted, and driven by clockwork. It was intended to take ten views during the totality. Mr. White, assisted by Mr. Black, directed the instruments for determining the position of the station and predicting the time of the different phases of the eclipse. On the morning of the 7th December a brick pier to support the transit instruments was built. The pier was made square, as the instruments had to be placed not only in the meridian for the accurate determination of the time and longitude, but also at right angles to the meridian for finding the altitude. The first observations were made by an eight-inch altazimuth, which does not require such a massive stand as the transit. This gave very nearly the local time and the direction of the meridian. By means of these data the transit was fixed at right angles to the meridian, the finding of the latitude by this method being more troublesome and requiring finer weather than the finding of the time. On the first night the sky was rather cloudy, so that only two complete observations could be taken. The next night three observations were obtained, and the third night four observations were made. This being considered sufficient for the latitude, the instrument was next morning placed in the meridian, but the weather was so unfavourable that no observations could be taken in that position, so that the altazimuth had to be resorted to for the time observations.

"The Sydney party were furnished with an equatorial telescope, made by Merz, of Munich, with $7\frac{1}{4}$in. clear aperture and 10ft. 4in. focal length, mounted on the German plan. Attached to the telescope was an apparatus for taking photographs in the principal focus of the object glass; also a photographic lens and camera, by which a second series of photographs could be taken simultaneously, the photographic lens having a 3in. aperture and 30in. focal length. There were, in addition, two small telescopes of 2in. aperture, with a magnifying power of 20, mounted equatorially and driven by clockwork, and a third telescope of $3\frac{1}{4}$in. aperture and 4ft. 6in. focal length. The party intended to take a double series of photographs, to make two independent drawings, and to make naked-eye drawings and observations. The duties were apportioned as follows:—Mr. Russell, the Government astronomer, was to take photographs with the large telescope; Mr. Beaufoy Merlin photographs with the camera, the Rev. W. Scott and Lieutenant Gowlland to make drawings with small telescope, and Mr. W. M'Donnell to act as timekeeper. The passengers were furnished with diagrams, and each received instructions to pay special attention to some one particular portion of the phenomena. When the day of the eclipse arrived the instruments were all working admirably. There had been numerous rehearsals to secure the utmost economy of time, and all felt that nothing but clear weather was needed for success.

"On Monday afternoon, the 11th of December, for the first time since leaving Melbourne, the sky became seriously overcast. The clouds had been gathered in dense dark masses all the earlier part of the evening, and at ten o'clock at night there was an awful thunderstorm, which lasted over an hour. The glow of the lightning, which came down in sheets of flame, and the rattle and crash of the thunder which followed the flash instantly, were inexpressibly grand. It was something quite beyond the experience of any one on board. A portion of the astronomical party returned from the shore in the middle of the storm. While they were ascending the ship's side the lightning struck the iron rigging, leaped across from stanchion to stanchion in balls of fire, and broke off at the ropes depending from the dead-eyes with loud crackling noises before it reached the sea. The vessel was lit up from stem to stern with a blinding light, and those on deck could see nothing for some seconds after each flash. The party in the boat were so much affected in this way that some alarm prevailed at first. Each one thought he had been deprived of sight, and asked his neighbour how it was with him. Had we been in a wooden ship the consequences would in all probability have been serious. This storm unfortunately did not clear the atmosphere. Next morning, the day of the eclipse, every eye was turned heavenward. To our dismay there was not a speck of sky to be seen. At ten o'clock there were several breaks in the clouds, and the sun showed himself for a few seconds, but an hour and a half later all was dense cloud again. Things looked brightest at mid-day, when there seemed to be a possibility of a fine afternoon. Then dark clouds swept up from the horizon, and extinguished almost every hope. At two o'clock there was yet another chance, though a faint one. This was tantalising. Every interest centred in a few patches of sky and their relations to the neighbouring clouds. They were aggravating clouds of every imaginable form and variety—cirrus, stratus, cumulus, nimbus—all were there at various times of the day, assuming the most distressing shapes, but giving no promise of dissolving.

"The computation of the duration of the eclipse was found to be very accurate, the eclipse occurring, as near as could be judged, three or four seconds before the predicted time. The computation was as follows:—First contact, 1h. 15m. 6s.; commencement of totality, 2h. 42m. 23s.; end of totality, 2h. 45m. 49s.; last contact, 4h. 1m. 6s. At the time of the first contact there was scarcely a rift in the canopy of clouds. The sun was wholly obscured. A few seconds later a passing glimpse was obtained, showing that the encroachment of the dark body of the moon on the bottom edge of the sun's disc had begun. Then all was dark again, excepting a faint luminous spot indicating the radiant body's position. A sharp shower fell at this time, and the instruments exposed had to be covered up. A drizzling rain continued during the remainder of the afternoon. At the faintest indication of a break in the clouds the astronomers ran out of their tents, and endeavoured to take observations, but without any result. Seven minutes before the commencement of totality there was a gleam of light from the sun, but the phase of the eclipse could not be discerned. We caught a momentary glimpse of the silver sickle of the sun at the top, just before the full obscuration. Then darkness fell suddenly like a pall on the surrounding objects, and we knew that totality had begun. It was a strange weird light at first. The large billowy clouds assumed olive and purple tints, and then changed to an ashen hue. These colours were reflected in the sea with some variations of light green and copper. Men looked livid in the light, and everything around had a most unearthly appearance. The steamer at anchor showed with a wonderful distinctness; every line, spar, and bit of cordage stood out against the horizon with the sharpness of a highly-magnified stereoscopic picture. There was no total darkness, owing, probably, to the amount of light diffused in the clouds. During totality, newspaper print could be read without much difficulty. Nor was there any perceptible diminution in the temperature. The three minutes and a half seemed exceedingly short. We saw nothing of the corona beyond a brief glimpse of a luminous mark shining faintly through the vapours. Some said they detected a decided red tinge. The clouds turned black, the tints disappeared from the sea, and utter darkness seemed coming upon us, when a few rays of light played upon the edges of a great bank of clouds in the N.W., some of the grey tints of dawn appeared, and daylight came back with a rush, as from the lifting of a veil. A hawk which had been sailing about swept down into a bush on the island to roost as soon as totality began. When daylight returned, he was astonished to find himself within a few feet of forty or fifty men, and flew off in wild alarm. Though daylight had returned, the sun was still hidden by the clouds. A minute later we faintly saw the re-appearance of the solar limb at the bottom like a fine luminous thread, when more clouds interposed and shut out the great luminary for the remainder of the afternoon. This was all that was vouchsafed to us of the grand phenomena of a total solar eclipse. Never was Nature more assiduously wooed to reveal her treasures to science. But it was all to no purpose. Of the upward and onward march of the moon, the successive disappearance of the solar spots, the brilliant breaking into view of Bailey's Beads, the passage of the shadow through the air, the rose-coloured prominences and coronal radiations during totality, the reappearance of the solar crescent, and the final retreat of the lunar shadow into space, we had seen nothing. No observation could be taken by instrument. Mr. Russell exposed a photographic plate for twenty seconds during totality, but got no result.

"Nothing remained but to pack up and head the ship for home. The work was commenced before the eclipse was over, the rain falling dismally all the time, and was completed in less than three hours. The disappointment to all was very great. It was especially felt by the astronomical party, but they bore it bravely, as became men who had faithfully performed their duty. When over dessert that evening Mr. Ellery proposed in the interests of science, "Success to the Other Eclipse Expeditions," there was not one who did not cordially wish that all the other observers might have presented to their view the radiant globe projected on an azure sky, instead of the mountains of dull cloud that desolated our hopes.

"Later in the evening the schooner *Matilda*, bound for Sydney, from Torres Strait, with twelve tons of pearl shell, came alongside. The master and first officer reported having seen the eclipse very distinctly while near Night Island, in lat. 13° 9′ S., long. 143° 39′ E., about 15 miles from No. VI. island. They were not aware that the eclipse was going to occur, and at first took the darkness for approaching bad weather, until one of them happening to look under the mainsail, observed the phenomenon. Though wholly unprepared for the eclipse, they gave a very intelligent account of it, on being carefully examined by Prof. Wilson. Mr. Walton, master of the *Matilda*, stated that he had just ordered some clothes that were drying to be taken down, as bad weather seemed to be coming on, when he happened to look up and see the eclipse. It was so dark that he had to light the binnacle lamp. On a diagram being handed to him, he correctly indicated the points of disappearance and first reappearance of the sun. He drew on a black disc a line showing the boundary of the ring of light round the dark body of the moon, narrower in the right-hand bottom quadrant, and wider, with a projection, in the left-hand top quadrant. The colour of the light, he said, was whitish, like ordinary sunlight. He was particularly asked if he saw any pink light, and said no. He described the boundary as being sharp, and clear towards the moon, but rough and irregular outwards. The breadth of the annulus which he drew was about 1-16th of the diameter of the black disc. He said he and the other officers differed as to the duration of the darkness. The time was variously guessed at from five to ten minutes. His own opinion was that it was seven or eight minutes. There were no clouds on the sun at the time, and the blue sky was visible. Some of the South Sea Islanders on board were very much alarmed, and wept plenteously. Mr. Hore, first officer of the *Matilda*, stated that on his attention being directed to the eclipse, he went below to fetch his sextant in order to use the dark glasses. The captain called to him to make haste, as he was losing the best of it. On coming on deck he saw the dark body of the moon, surrounded by a fine ring of red light, outside of which was a broader ring of paler red light; while all outside of that was as black as night. His drawing on the card showed the breadth of the inner ring to be one-eighth the diameter of the moon, and the breadth of the outer on to be seven-sixteenths of the diameter of the moon. On being pressed as to the colour, he said it was not like fire itself, but like the glow of fire when the fire is concealed. The illustration he used was the glow of a house on fire seen from behind another house. Only one cloud passed over the sun during the eclipse, and that was a very small one. Peter R. Cooper, carpenter on board the *Matilda*, drew a line showing the boundaries of the inner and outer annuli, the inner one extending rather more than half round, the point of first reappearance being the middle of it, the outer one extending less than a quadrant, and being entirely on the upper right-hand side. He described the colour as being like the upper ground part of a kerosene lamp shade in the cabin to which he pointed. The sun looked watery. When he first saw it it was coming from behind scud. There was no sky which could be called blue. It was a whitey sky. Cooper's drawing was marked with radial lines extending across the outer annulus from the inner.

"The return voyage was begun at daylight on the morning of the 13th of December. The only lasting traces of the astronomers left on the island were the photographers' dark rooms and the brick foundations used for the instruments, in which were entombed two bottles containing coins and newspapers and some particulars of the expedition. A member of the party, animated by something of the spirit of Old Mortality in his desire to preserve from oblivion the mortuary memorials of the expedition, inscribed this touching record on the slab which formed the top of one of these pedestals:—'Sacred to the memory of the Australian Eclipse Expedition.'"

SOCIETIES AND ACADEMIES

London

Royal Society, February 15.—"On the Induction of Electric Currents in an infinite plane sheet of uniformly conducting matter," by Prof. Clerk Maxwell, F.R.S.

The currents are supposed to be induced in the sheet by the variation in position or intensity of any system of magnets or electromagnets.

When any system of currents is excited in the sheet, and then left to itself, it gradually decays, on account of the resistance of the sheet. At any point on the positive side of the sheet, the electromagnetic action is precisely the same as if the sheet, with its currents, retaining their original intensity, had been carried away in the negative direction with a constant velocity R, where R is the value, in electromagnetic measure, of the resistance of a rectangular portion of the sheet, of length 1 and breadth 2π. This velocity, for a sheet of copper of best quality of one millimetre thickness, is about twenty-five metres per second, and is, therefore, in general comparable with the velocities attainable in experiments with rotating apparatus.

When an electromagnet is suddenly excited on the positive side of the sheet, a system of currents is induced in the sheet, the effect of which on any point on the negative side is, *at the first instant*, such as exactly to neutralise the effect of the magnet itself. The effect of the decay of this system of currents is therefore equivalent to that of an image of the magnet, equal and opposite to the real magnet, from the position of the real magnet, in the direction of the normal drawn away from the sheet, with the constant velocity R.

When any change occurs in an electromagnetic system, whether by its motion or by the variation of its intensity, we may conceive the change to take place by the superposition of an imaginary system upon the original system; the imaginary system being equivalent to the difference between the original and the final state of the system.

The currents excited in the sheet by this change will gradually decay, and their effect will be equivalent to that of the imaginary system carried away from the sheet with the constant velocity R.

When a magnet or electro-magnet moves or varies in any continuous manner, a succession of imaginary magnetic systems like those already described is formed, and each, as it is formed, begins to move away from the sheet with the constant velocity R. In this way a train or trail of images, is formed, moves off, parallel to itself, away from the sheet, as the smoke of a steamer ascends in still air from the moving funnel.

When the sheet itself is in motion, the currents, relatively to the sheet, are the same as if the sheet had been at rest, and the magnets had moved with the same relative velocity. The only difference is, that whereas when the sheet is at rest no difference of electric potential is produced in different parts of the sheet, differences of potential, which may be detected by fixed electrodes are produced in the moving sheet.

The problem of Arago's whirling disc has been investigated by MM. Felici and Jochmann. Neither of these writers, however, has solved the problem so as to take into account the mutual induction of the currents in the disc. This is the principal step made in this paper, and it is expressed in terms of the theory of images, by which Sir W. Thomson solved so many problems in Statical Electricity. In the case of the whirling disc, the trail of images has the form of a helix, moving away from the disc with velocity R, while it revolves about the axis along with the disc. Besides the dragging action which the disc exerts on the magnetic pole in the tangential direction, parallel to the motion of the disc, the theory also indicates a repulsive action directed away from the disc, and an attraction towards the axis of the disc, provided the pole is not placed very near the edge of the disc, a case not included in the investigation. These phenomena were observed experimentally by Arago, *Ann. de Chimie*, 1826.

February 22.—"On a New Hygrometer." By Mr. Wildman O. Whitehouse.

"On the Contact of Surfaces." By William Spottiswoode, M.A., Treas. R.S.

In a paper published in the "Philosophical Transactions" (1870, p. 289), I have considered the contact, at a point P, of two curves which are co-planar sections of two surfaces (U, V); and have examined somewhat in detail the case where one of the curves, viz., the section of V, is a conic. In the method there employed, the conditions that the point P should be sextatic, involved the azimuth of the plane of section measured about an axis passing through P; and consequently, regarded as an equation in the azimuth, it showed that the point would be sextatic for certain definite sections. It does not, however, follow, if conics having six-pointic contact with the surface U be drawn in the planes so determined, that a single quadric surfaee can be made to pass through them all. The investigation therefore of the memoir above quoted was not directly concerned with the contact of surfaces, although it may be considered as dealing with a problem intermediate to the contact of plane curves and that of surfaces.

In the present investigation I have considered a point P common to the two surfaces, U and V; an axis drawn arbitrarily through P; and a plane of section passing through the axis and capable of revolution about it. Proceeding as in the former memoir, and forming the equations for contact of various degrees, and finally by rendering them independent of the azimuth, we obtain the conditions for contact for all positions of the cutting plane about the axis. Such contact is called circumaxal; and in particular it is called uniaxal, biaxal, &c., according as it subsists for one, two, &c. axes. If it holds for all axes through the point it is called superficial contact; and in the memoir some theorems are established relating to the number of sections along which contact of a given degree must subsist in order to ensure uniaxal contact, as well as to the connection between uniaxal and multiaxal contact. At the conclusion of sec. 3 it is shown that the method of plane sections may, in the cases possessing most interest and importance, be replaced by the more general method of curved sections.

In the concluding section a few general considerations are given relating to the determination of surfaces having superficial contact of various degrees with given surfaces; and at the same time have indicated how very much the general theory is affected by the particular circumstances of each case. The question of a quadric having four-pointic superficial contact with a given surface is considered more in detail; and it is shown how in general such a quadric degenerates into the tangent plane taken twice. To this there is an apparently exceptional case, the condition for which is given and reduced to a comparatively simple form; but I must admit to having so left it, in the hope of giving a fuller discussion of it on a future occasion.

The subject of three-pointic superficial contact was considered by Dupin, "Développements de Géométrie," p. 12, and, as I have learnt since the memoir was written, a general theorem connecting superficial contact and contact along various branches of the curve of intersection of two surfaces (substantially the same as that given in the text) was enunciated by M. Moutard.*

In a corollary to this theorem, M. Moutard states that through every point of a surface there can be drawn twenty-seven conics, having six-pointic contact with the surface. This number is perhaps open to question; and I have even reason to think, from considerations stated to me by Mr. Clifford, that the number ten, given in my memoir above quoted, may be capable of reduction by unity to nine. But this question refers to the subject of that earlier memoir rather than to this.

Geological Society, February 7.—Mr. Prestwich, F.R.S., president, in the chair. 1. "Further Notes on the Geology of the neighbourhood of Malaga," by M. D. M. d'Orueta. In this paper, which is a continuation of a former note laid

* Poncelet, "Applications d'Analyse à la Géométrie," 1864, tom. ii. p. 363

before the society (*see* Q. J. G. S. xxvii., p. 109), the author commenced by stating that his former opinion as to the Jurassic age of the rocks of Antequera is fully borne out by later researches upon their fossils. They apparently belong to the Portlandian series. The author made considerable additions to his description of the Torcal, near the foot of which he has found a sandstone containing abundance of *Gryphæa virgula* and *Ostrea deltoidea.* This he regards as equivalent to the Kimmeridge clay. In the Torcal he has also found a soft, white, calcareous deposit, overlying the limestones of supposed Portlandian age, and containing a fossil which he identifies with the Tithonian *Terebratula diphya.* The author discussed the peculiar forms assumed by the rocks of the Torcal under denudation, which he supposed to be due originally to the upheaval caused by the rising of a great mass of greenstone, portions of which are visible at the surface on both sides of the range. 2. "On the River-courses of England and Wales," by Prof. A. C. Ramsay, F.R.S., The author commenced by describing the changes in the physical conformation of Britain during the Jurassic and Cretaceous periods, and the relations which the deposits found during those periods bore to the Palæozoic rocks of Wales and the north-west of England. He stated that the Miocene period of Europe was essentially a continental one, and that it was closed by important disturbances of strata in central Europe, one effect of which would be to give the secondary formations of France and Britain a slight tilt towards the north-west. To this he ascribed the north-westerly direction of many of the rivers of France; and he surmised that at this period the rivers of the middle and south of England also took a westerly course. The westerly slope of the cretaceous strata of England was also, he considered, the cause of the southern flow of the Severn, between the hilly land of Wales and the long slope of chalk rising towards the east. The Severn would thus establish the commencement of the escarpment of the chalk, which has since receded far eastward. The author believed that after the Severn had cut out its valley the cretaceous and other strata were gradually tilted eastwards, causing the easterly course of the Thames and other rivers of southern and eastern England. In these and other cases adduced by the author, the sources of these rivers were originally upon the chalk near its escarpment; and it is by the recession of the latter (which was followed by the formation of the oolitic escarpment) that its present relation to the river-courses has been brought about. The author also referred to the courses followed by the rivers of the more northern part of England, and indicated their relations to the general dip of the strata.

Geological Society, February 16.—Mr. Joseph Prestwich, F.R.S., president, in the chair.—The Secretary read the reports of the council, of the Library and Museum Committee, and of the auditors. The general position of the society was described as satisfactory, although, owing to the number of deaths which had taken place among the Fellows during the year 1871, the society did not show the same increase which has characterised former years. In presenting the Wollaston gold medal to the Secretary, Mr. David Forbes, for transmission to Prof. Dana, of Yale College, Connecticut, the President said:—"I have the pleasure to announce that the Wollaston Medal has been conferred on Prof. Dana, of Yale College, Newhaven, U.S.; and in handing it to you for transmission to our Foreign Member, I beg to express the great gratification it affords me that the award of the Council has fallen on so distinguished and veteran a geologist. Prof. Dana's works have a world-wide reputation. Few branches of geology but have received his attention. An able naturalist and a skilful mineralogist, he has studied our science with advantages of which few of us can boast. His contributions to our science embrace cosmical questions of primary importance—palæontological questions of special interest—recent phenomena in their bearings on geology, and mineralogical investigations so essential to the right study of rocks, especially of volcanic phenomena. The wide range of knowledge he brought to bear in the production of his excellent treatise on Geology, one of the best of our class books, embracing the elements as well as the principles of geology. His treatise on Mineralogy exhibits a like skill in arrangement and knowledge in selection. In conveying this testimonial of the high estimation in which we hold his researches to Prof. Dana, may I beg also that it may be accompanied by an expression how strongly we feel that the bonds of friendship and brotherhood are connected amongst all civilised nations of the world by the one common, the one universal, and the one kindred pursuit of truth in the various branches of science."—Mr. David Forbes, in reply, said that it was to him a great pleasure to have, in the name of Prof. Dana, to return thanks to the society for their highest honour, and for this mark of the appreciation in which his labours are held in England. It had rarely if ever occurred in the history of the society that the Wollaston medal had been awarded to any geologist who had made himself so well known in such widely different departments of the science, for not only was Prof. Dana pre-eminent as a mineralogist, but his numerous memoirs on the Crustaceans, Zoophytes, coral islands, volcanic formations, and other allied subjects, as well as his admirable treatise on general Geology, fully testify to the extensive range and great depth of his scientific researches.—The President then presented the balance of the proceeds of the Wollaston donation fund to Prof. Ramsay, F.R.S., for transmission to Mr. James Croll, and addressed him as follows:—"The Wollaston fund has been awarded to Mr. James Croll, of Edinburgh, for his many valuable researches on the glacial phenomena of Scotland, and to aid in the prosecution of the same. Mr. Croll is also well known to all of us by his investigation of oceanic currents and their bearings on geological questions, and of many questions of great theoretical interest connected with some of the great problems in Geology. Will you, Prof. Ramsay, in handing this token of the interest with which we follow his researches, inform Mr. Croll of the additional value his labours have in our estimation, from the difficulties under which they have been pursued, and the limited time and opportunities he has had at his command."—Prof. Ramsay thanked the president and council in the name of Mr. Croll for the honour bestowed on him. He remarked that Mr. Croll's merits as an original thinker are of a very high kind, and that he is all the more deserving of this honour from the circumstance that he has risen to have a well-recognised place among men of science without any of the advantages of early scientific training; and the position he now occupies has been won by his own unassisted exertions. The President then proceeded to read his Anniversary Address, in which he discussed the bearings upon theoretical Geology of the results obtained by the Royal Commission on Water-Supply and the Royal Coal Commission. The Address was prefaced by biographical notices of deceased Fellows, including Sir Roderick I. Murchison, Mr. William Lonsdale, Sir Thomas Acland, Sir John Herschel, Mr. George Grote, Mr. Robert Chambers, and M. Lartet.—The ballot for the Council and Officers was taken, and the following were duly elected for the ensuing year:—President—The Duke of Argyll, K.T., F.R.S. Vice-Presidents—Prof. P. Martin Duncan, F.R.S., Prof. A. C. Ramsay, F.R.S., Warington W. Smyth, F.R.S., Prof. John Morris. Secretaries—John Evans, F.R.S., David Forbes, F.R.S. Foreign Secretary, Prof. T. D. Ansted, F.R.S. Treasurer—J. Gwyn Jeffreys, F.R.S. Council—Prof. T. D. Ansted, F.R.S., the Duke of Argyll, F.R.S., W. Carruthers, F.R.S., W. Boyd Dawkins, F.R.S., Prof. P. Martin Duncan, F.R.S., R. Etheridge, F.R.S., John Evans, F.R.S., James Fergusson, F.R.S., J. Wickham Flower, David Forbes, F.R.S., Capt. Douglas Galton, C.B., F.R.S., Rev. John Gunn, M.A., J. Whitaker Hulke, F.R.S., J. Gwyn Jeffreys, F.R.S., Sir Charles Lyell, Bart., F.R.S., C. J. Meyer, Prof. John Morris, Joseph Prestwich, F.R.S., Prof. A. C. Ramsay, F.R.S., R. H. Scott, F.R.S., W. W. Smyth, F.R.S., Prof. J. Tennant, Henry Woodward.

Zoological Society, February 20, Prof. Flower, F.R.S., in the chair.—The secretary read a report on the additions that had been made to the society's menagerie during the month of January, 1872, and called particular attention to a young king penguin (*Apterodytes pennanti*), presented by Mr. F. P. Cobb, of Port Stanley, Falkland Islands, and to a collection of African land tortoises, transmitted by Dr. Grey of Cradock, Cape Colony.—The secretary also called attention to the female Sumatran rhinoceros (*Rhinoceros sumatrensis*) just added to the society's menagerie.—A paper was read by Mr. J. W. Clark, on the visceral anatomy of the hippopotamus, as observed in the young specimen of this animal which had died in the society's gardens on the 10th January, 1872. After giving an account of the morbid appearances noticed, Mr. Clark described in detail the stomach of this specimen, which appeared to differ in some points from those examined by previous authorities.—A communication was read from Dr. J. S. Bowerbank, F.R.S., containing the second part of his "Contributions to a General History of the Spongiadæ," in which was contained a full account of two species of the genus *Geodia.*—A paper by the

Rev. O. P. Cambridge was read, "On the Spiders of Palestine and Syria," in which was given a general list of the Araneidea of those countries, together with descriptions of numerous new species, and the characters of two new genera. — A communication was read from Dr. John Anderson, containing descriptions of some Persian, Himalayan, and other reptiles, either new or little known to science. A second paper by Dr. Anderson contained some further remarks on the external characters of the new Burmese macaque, which he had recently described under the name *Macacus brunneus*.—A communication was read from Count Thomaso Salvadori, containing a note on a specimen of Lidth's jay (*Garrulus lidthii*), in the collectian of the King of Italy, which had originally been received alive from Japan. Mr. D. G. Elliot read a note on a Cat described by Dr. Gray in the Proceedings of the Zoological Society for 1867, as *Felis pardinoides* from India, which Mr. Elliot considered to be identical with *Felis Geoffroyii* of S. America.

MANCHESTER

Literary and Philosophical Society, February 6.—E. W. Binney, F.R.S., president, in the chair. Dr. Joule, F.R.S., called attention to the very extraordinary magnetic disturbances on the afternoon of the 4th instant, and from which he anticipated the aurora which afterwards took place. The horizontally suspended needle was pretty steady in the forenoon of that day, but about 4 P.M. the north end was deflected strongly to the east of the magnetic meridian, and afterwards still more strongly to the west. The following were the observations made :—

Time	Deflection from the Magnetic Meridian. ° ′	Time	Deflection from the Magnetic Meridian. ° ′
4.0 P.M.	0 50 E.	6.10 P.M.	1 24 W.
4.30 ,,	0 47 W.	6.12 ,,	1 [illegible]8 ,,
4.55 ,,	2 22 ,,	7.41 ,,	0 10 ,,
4.58 ,,	3 0 ,,	7.43 ,,	0 0 ,,
5.9 ,,	3 45 ,,	8.9 ,,	0 42 ,,
5.12 ,,	0 52 ,,	8.31 ,,	0 10 ,,
5.23 ,,	5 36 ,,	8.54 ,,	1 18 ,,
5.24 ,,	2 28 ,,	8.58 ,,	0 52 ,,
5.35 ,,	0 52 ,,	11.3 ,,	0 5 ,,
5.55 ,,	0 52 ,,		

Mr. Sidebotham states that he also expected the magnificent aurora on account of the violent disturbance of the needle at Bowdon, amounting to at least 3°. Observation with the spectroscope by Dr. Joule showed a bright and almost colourless line near the yellow part of the spectrum. This line appeared in whatever part of the heavens the instrument was directed, and could be plainly seen when the sky was covered with clouds and rain was falling. When looking at the most brilliant red light of the aurora a faint red light was seen at the red end of the spectrum, and beyond the bright white line, towards the violet end, two broad bands of faint white light. Mr. Thomas Harrison stated that he saw the aurora on last Sunday evening from $6^h\ 15^m$ to $9^h\ 30^m$ and took spectroscopic observations thereon from various parts of the sky. In each case, however, he discovered only one bright yellow line, situated between D and E, being on Kirchhoff's scale about 1255 to 1260. He is not acquainted with any known substance that gives a corresponding line. The line throughout was very clear and decided, both in the narrow and wide slit; but he failed to discover any continuous spectrum. The line was also very perceptible by reflection from those parts of the sky in which no trace of aurora was visible; and although the streaks were both red and white, the spectroscope appeared to give the aurora as a monochromatic light.

KILKENNY

Royal Historical and Archæological Association of Ireland, January 17.—The Mayor of Kilkenny in the chair. Rev. J. Graves (hon. sec.) read the report for 1871. The following members were elected :—Earl of Dunraven, Rev. W. H. Fraser, L. Daniel, J. Lloyd, G. Reade, W. Irvine, J. Martin, W. J. Lemon, A. Gibb, A Menzies, F. Barton, and W. Moore; the Rev. Dean Watson and B. Delanny, were raised to Fellows. —"Historical Documents of 1644" were exhibited by the hon. sec., one of which contained a key to the cipher used in the correspondence between Ormonde and the confederate leaders at the time. The following papers were read: "On a recent discovery of Coins at Mullaboden, Ballymore Eustace, co. Kildare," by Rev. J. F. Shearman; "On Kilkenny, past and present," by P. Watters; "On some Unrecorded Antiquities in Yar-Connaught," by G. H. Kinahan; "On some Antiquities of Oak at Bellisle, co. Fermanagh," by W. F. Wakeman.

BOOKS RECEIVED

ENGLISH.—Principles of Geology, 11th edition, Vol. i.: Sir C. Lyell (J. Murray).—Scottish Meteorology, 1855-1871, Edinburgh Observatory.—A Treatise on the Theory of Friction: J. H. Jellett (Macmillan).—The Climate of Uckfield: C. L. Prince (Churchill).

AMERICA.—Transactions ot the Albany Institute, Vols. 1-6.—Transactions of the Society for the Promotion of Useful Arts in the State of New York, Vol. iv., Part ii.—Annals of the Dudley Institute, Vols. i. and ii.—Annual Address before the Albany Institute: O. Meads.—The Advice of a Father to his Son: N. François.

DIARY

THURSDAY, FEBRUARY 29.

ROYAL SOCIETY, at 8.30.—On the relative Power of 34 Substances to Prevent the Development of Protoplasmic and Fungus Life, and in Arresting Putrefaction: Prof. Crace-Calvert, F.R.S.

SOCIETY OF ANTIQUARIES, at 8.30.—Further Facts in the History of the Early Discovery of Australia: R. H. Major, F.S.A.

FRIDAY, MARCH 1.

ROYAL INSTITUTION, at 9.—Measuring Temperature by Electricity: C. W. Siemens.

GEOLOGISTS' ASSOCIATION, at 8.—On the Geology of Hampstead, Middlesex: C. Evans, F.G.S.—Note on a recently exposed Section at Battersea: J. A. Coombs.

ARCHÆOLOGICAL INSTITUTE, at 4.

SATURDAY, MARCH 2.

ROYAL INSTITUTION, at 3.—Demonology: M. Conway.

SUNDAY, MARCH 3.

SUNDAY LECTURE SOCIETY, at 4.—On the Icelandic Language and its similarity to English. The Literature of Iceland, Old and Modern: Jon A. Hjaltalin.

MONDAY, MARCH 4.

ENTOMOLOGICAL SOCIETY, at 7.

ANTHROPOLOGICAL INSTITUTE, at 8.—Anthropological Collections from the Holy Land, No. III.: Capt. R. F. Burton and Dr. C. Carter Blake.—Race Characteristics as related to Civilisation: J. Gould Avery.

LONDON INSTITUTION, at 4.—Elementary Chemistry: Prof. Odling, F.R.S.

ROYAL INSTITUTION, at 2.—General Monthly Meeting.

TUESDAY, MARCH 5.

ZOOLOGICAL SOCIETY, at 9.—Notes on an Ostrich, recently living in the Society's collection; A. H. Garrod.—Catalogue of the Birds found in Ceylon, with some remarks on their habits and local distribution, and descriptions of two new species peculiar to the Island: E. W. H. Holdsworth.

SOCIETY OF BIBLICAL ARCHÆOLOGY, at 8.30.

ROYAL INSTITUTION, at 3.—On the Circulatory and Nervous Systems: Dr. Rutherford.

WEDNESDAY, MARCH 6.

GEOLOGICAL SOCIETY, at 8.—On *Prognathus Güntheri* (Egerton), a new genus of Fossil Fish from the Lias of Lyme Regis; On two Specimens of Ischyodus from the Lias of Lyme Regis: Sir P. de M. Grey-Egerton, Bart., M.P., F.R.S.—How the Parallel Roads of Glen Roy were formed: Prof. James Nichol, F.G.S.—Notes on Atolls or Lagoon Islands: S. J. Whitnell.

SOCIETY OF ARTS, at 8.—On the *Goliath* Training Ship: Capt. Bourchier.

MICROSCOPICAL SOCIETY, at 8.

PHARMACEUTICAL SOCIETY, at 8.

THURSDAY, MARCH 7.

ROYAL SOCIETY, at 8.30.

SOCIETY OF ANTIQUARIES, at 8.30.

ROYAL INSTITUTION, at 3.—On the Chemistry of Alkalies and Alka Manufacture; Prof Odling, F.R.S.

LINNEAN SOCIETY, at 8.

CHEMICAL SOCIETY, at 8.

CONTENTS

NOTICE

We beg leave to state that we decline to return rejected communications, and to this rule we can make no exception. Communications respecting Subscriptions or Advertisements must be addressed to the Publishers, NOT *to the Editor.*