THURSDAY, FEBRUARY 1, 1872

THE INTERNAL FLUIDITY OF THE EARTH

WE have been favoured with permission to reprint the following extract from a letter addressed by Sir Wm. Thomson to Mr. G. Poulett Scrope:—

The University, Glasgow, *Jan.* 15, 1872

DEAR SIR,—I thank you very much for the copy of your beautiful book on Volcanoes, which you have been so kind as to send me through Professor Geikie. It is full of matter most interesting to me, and I promise myself great pleasure in reading it.

I see with much satisfaction, in your prefatory remarks, that you "earnestly protest against the assertion of some writers, that the theory of the internal fluidity of the globe is or ought to be generally accepted by geologists on the evidence of its high internal temperature." Your sentence upon the "attractive sensational idea that a molten interior to the globe underlies a thin superficial crust; its surface agitated by tidal waves and flowing freely towards any issue that may here and there be opened for its outward escape," in which you say that you "do not think it can be supported by reasoning, based on any ascertained facts or phenomena," is thoroughly in accordance with true dynamics. It will, I trust, have a great effect in showing that volcanic phenomena, far from being decisive, as many geologists imagine them to be, in favour of a thin crust enclosing a wholly liquid interior, tend rather, the more thoroughly they are investigated, to an opposite conclusion.

I must, however, take exception to your next sentence, that in which you say that "M. Delaunay has disposed of the well-known astronomical argument of Mr. Hopkins and Sir W. Thomson, as to the entire or nearly entire solidity of the earth, derived from the nutation of its axis." Delaunay's deservedly high reputation as one of the first physical astronomers of the day, has naturally led many in this country to believe that his objection to the astronomical argument in favour of the earth's rigidity cannot but be valid. It has even been hastily assumed that the objection is founded on mathematical calculation, an error which the most cursory reading of Delaunay's paper corrects. His hypothesis of a viscous fluid breaks down utterly when tested by a simple calculation of the amount of tangential force required to give to any globular portion of the interior mass the precessional and nutational motions, which, with other physical astronomers, he attributes to the earth as a whole. Thus: taking the ratio of polar diameter to equatorial diameter as 299 to 300, and the density of the upper crust as half the mean density of the earth, I find (from the ordinary elementary formulæ) that when the moon's declination is $28^\circ\frac{1}{2}$, the couple with which she tends to turn the plane of the earth's equator towards the plane of her own centre and the equinoctial line has for its moment a force of $\cdot 285 \times 10^{18}$ times the gravity of one gramme at the earth's surface, or rather more than a quarter of a million million tons weight, on an arm equal to the earth's radius. A quadrant of the earth being ten thousand kilometres, the area is five hundred and nine million square kilometres, or $5\cdot 09$ million million million square centimetres. Hence a force of $\cdot 285 \times 10^{18}$ grammes weight distributed equally over two-thirds of the earth's area would give $\cdot 084$ of a gramme weight per square centimetre. This supposition is allowable (for reasons with which I need not trouble you) in estimating roughly the greatest amount of tangential force acting between the upper crust and a spherical interior mass in contact with it, from the preceding accurate calculation of the whole couple exerted by the moon on the upper crust. It is thus demonstrable that the earth's crust must, as a whole, down to depths of hundreds of kilometres, be capable of transmitting tangential stress amounting to nearly $\frac{1}{10}$ of a gramme weight per square centimetre. Under any of such stress as this any plastic substance which could commonly be called a viscous fluid would be drawn out of shape with great rapidity. Stokes, who discovered the theory of fluid viscosity, and first made accurate investigations of its amount in absolute measure, found that a cubic centimetre of water, if exposed to tangential force of the millionth part of $\frac{1}{10}$ of a gramme weight on each of four sides, would even under so small a distorting stress as this, become distorted so rapidly that at the end of a second of time its four corresponding right angles would become one pair of them acute and the other obtuse, by as much as a two-hundredth part of the angle whose arc is radius, that is to say by $\cdot 29$ of a degree. Not as much as a ten-million-millionth part of this distortion could be produced every second of time by the lunar influence in the material underlying the earth's crust without very sensibly affecting precession and nutation; for the effect of the maximum couple exerted on the upper crust by the moon is to turn the whole earth in a second of time through an angle of a one-hundred-million-millionth of $\cdot 57$ of a degree, so as to give to it at the end of a second the position obtained by geometrically compounding this angular displacement with the angular displacement due simply to rotation. Hence the viscosity assumed by Delaunay, to produce the effect he attributes to it, must be more than ten million million million times the viscosity of water. How much more may be easily estimated with some degree of precision from Helmholtz's mathematical solution of the problem of finding the motion of a viscous fluid contained in a rigid spherical envelope urged by periodically varying couples.* The most interesting part of the application of this solution to the hypothetical problem regarding the earth, is to find how rapidly the obliquity of the ecliptic would be done away with by any assumed degree of viscosity in the interior; such an amount of viscosity, for example, as would render the excesses of precession and nutation above their values for a perfectly rigid interior, not greater than observation could admit.

The hypothesis of a continuous internal viscous fluid being disposed of, the question occurs, what rigidity must the interior mass have, even if enclosed in a perfectly rigid crust, to produce the actual phenomena of precession and nutation? The solutions given by Lamé and myself of the problem of the vibrations of an elastic solid globe, may be readily applied to determine the influences on precession and on the several nutations, which would be produced by elastic yielding with any assumed rigidity

* Helmholtz and Piotrowski, "Ueber Reibung tropfbarer Flüssigkeiten,' Imp. Acad. Vienna, 1860.

short of infinite rigidity. This application I have no time at present to make; but without attempting a rigorous investigation, it is easy roughly to estimate an inferior limit to the admissable rigidity. In the first place, suppose, with perfect elasticity, the rigidity be so slight that distorting stress of $\frac{1}{10}$ of a gramme weight would produce an angular distortion of a half degree or a degree. The whole would not rotate as a rigid body round one "instantaneous axis" at each instant, but the rotation would take place internally, round axes deviating from the axis of external figure, by angles to be measured in the plane through it and the line perpendicular to the ecliptic in the direction towards the latter line. These angular deviations would be greater and greater the more near we come to the earth's centre, and the greatest angular deviation would be comparable with 1°. Hence the moment of momentum round the solsticial line would be sensibly less than if the whole mass rotated round the axis of figure. Now suppose for a moment our measurement of force to be founded on a year as the unit of time. We find the amount of precession in a year by dividing the mean amount of the whole couple due to the influence of moon and sun by the moment of momentum of the earth's motion round the solsticial line. Hence the amount of precession would be sensibly augmented by the elastic yielding; for the motive couple is uninfluenced by the elastic yielding, if we suppose the earth to be of uniform internal density. An ordinary elastic jelly presents a specimen of the degree of elasticity here supposed, as is easily seen when we consider that the mass of a cubic centimetre of such material is a gramme, and therefore that the weight of a cubic centimetre of the substance is the "gramme weight" understood in the specification $\frac{1}{10}$ of a gramme weight per square centimetre. If then, the interior mass of the earth were no more rigid than an ordinary elastic jelly, and if the upper crust were rigid enough to resist any change of figure that could sensibly influence the result, the precession would be considerably more rapid than if the rigidity were infinite throughout. The lunar nineteen-yearly nutation proves a higher degree of elasticity than this; the solar semi-annual nutation still a higher degree; and still higher yet the imperceptibility of the lunar fortnightly nutation; provided always we suppose the interior mass to be of uniform density, and the upper crust rigid enough to permit no influential change of figure.

The motive of the nineteen-yearly precession may be mechanically represented by two circles of matter pivoted on diameters fixed in the plane of the earth's equator, bisecting one another perpendicularly at the earth's centre. These two circles must oscillate round their pivot-diameters, each through an angle of about 5° on one side and the other of the plane of the equator, in a period of about nineteen years, to produce the lunar nineteen-yearly nutation (more nearly eighteen years seven months). If the radius of each of the supposed material circles is equal to the moon's mean distance from the earth, the mass of each must be a little less than the moon's mass, and one of them a little less than the other.* The diameter on which the latter is pivoted is to be the equinoctial line. The latter alone causes the nutation in right ascension; the former the nutation in declination. The phases of maximum and of zero deflection, in the oscillations of the two circles, follow alternately at equal intervals of time, so that when either is in the plane of the earth's equator, the other is at its greatest inclination of 5° on either side. Taking one of the constituents of the nutational motive alone, we find, on the principles indicated above, $\frac{1}{100}$ of a gramme weight per square centimetre as a very rough estimate for the greatest tangential stress produced by it in the material underlying the earth's crust. Now it is clear that the central parts of the earth and the upper crust cannot, in the course of the nutatory oscillations, experience relative angular motions to any extent considerable in comparison with the nutation of the upper crust, without considerably affecting the whole amount of the nutation. The nutation in declination amounts to $9''\cdot25$ on each side of the mean position of the earth's poles, and therefore the tangential stress of $\frac{1}{100}$ of a gramme weight per square centimetre cannot produce an angular distortion considerable in comparison with $9''$.

* The greater is equal to the moon's mass multiplied by the cosine of the obliquity of the ecliptic; the less is equal to the moon's mass multiplied by the cosine of twice the obliquity of the ecliptic.

An angular distortion of $8''$ is produced in a cube of glass by a distorting stress of about ten grammes weight per square centimetre. We may, therefore, safely conclude that the rigidity of the earth's interior substance could not be less than a millionth of the rigidity of glass without very sensibly augmenting the lunar nineteen-yearly nutation. The lunar fortnightly nutation in declination amounts theoretically to about $\cdot1''$, and it is so small as to have hitherto escaped observation. It probably would have been so large as to have been observed were the interior rigidity of the earth anything less than $\frac{1}{200000}$ of that of glass, always provided that the upper crust is rigid enough to prevent any change of form sensibly influencing the nutational motive couple. To understand the degree of rigidity meant by "$\frac{1}{200000}$ of the rigidity of glass," imagine a sheet of some such substance as gutta-percha or vulcanised india-rubber of a square metre area and a centimetre thickness. Let one side of the sheet be cemented to a perfectly hard plane vertical wall, and let a slab of lead 8·8 centimetres thick (weighing therefore a metrical ton)* be cemented to the other side of it. If the rigidity of the substance be $\frac{1}{200000}$ of the rigidity of glass,† and the range of its elasticity sufficient, the side of the sheet to which the lead is attached will be dragged down relatively to the other through a space of $\frac{1}{12}$ of a centimetre.

In the argument from tidal deformations of the solid part of the earth's material, which I communicated to the Royal Society ten years ago, and mentioned incidentally at the recent meeting of the British Association, I showed that though precession and nutation would be augmented by want of rigidity in the interior, they would be diminished by want of rigidity in the upper crust, and that on no probable hypothesis can we escape the conclusion that the earth as a whole is less yielding than a globe of glass of the same dimensions and exposed to the same forces. That argument, therefore, proves about 200,000 times greater rigidity for the earth as a whole than what I

* The metrical ton, or the mass of a cubic metre of water at temperature of maximum density, is ·9842 of the British ton. The thickness of a slab of lead of a square metre area, weighing a metrical ton, is, of course, equal to a metre divided by the specific gravity of lead.

† Everett's measurements give 244×10^6 centimetres weight per square centimetre for the rigidity of the glass on which he experimented. Instead of this I take 240×10^6, for simplicity.

have now written to you proves for the interior of the earth on the supposition of a thin preternaturally rigid crust.

I must apologise to you for having troubled you with so long a letter. I did not intend to make it so long when I commenced, but I have been led on by considerations of details, inevitable when such a subject is once entered upon.—I remain, yours very truly,

WILLIAM THOMSON

G. Poulett Scrope, Esq., F.R.S.

THE SOLAR ECLIPSE

IN the communication to NATURE, written from Ootacamund, I promised another when I was in possession of more information as to the work done, not only by the British Association parties, but by those representing the Indian and French Governments. Let me now endeavour to redeem my promise, seeing that since that communication was penned I have had the happiness of hearing from M. Janssen's own lips an account of what he did; have met Captain Waterhouse, the last representative at Ootacamund of Colonel Tennant's party; have visited Mr. Pogson at Madras, who obligingly gave me an account of the results obtained at Avenashi; and last, but not least, have learnt since my return home that the Jaffna party were successful, not only with the polariscope, but also with the camera and spectroscope.

Within a few minutes of the despatch of my last article I found that Captain Waterhouse, who assisted Mr. Hennessy in exposing the photographic plates taken by Colonel Tennant's party, was still at Ootacamund, and this welcome intelligence was soon followed by Captain Waterhouse himself, who was so good as to bring with him a drawing of one of the photographs; the plates themselves having been taken down the ghaut by Colonel Tennant, with the intention of comparing them at Pothonore with those taken by Mr. Davis. Unfortunately, as has been already stated, we missed each other, and so an absolute comparison of photographs did not take place; but from the drawing it was evident that in the two series the main form of the corona was the same. The photographs I learned were very sharp and good, and one appreciates their value the more when it is known that only a very little time before they were taken, any success, even a partial one, seemed out of the question, so persistently did cloud and mist hang over Dodabet on the eventful morning. I gathered that the spectroscopic observations had also been successful, and that a continuous spectrum with 1474 had been observed. If more lines than this were not seen, it is easily to be accounted for by the relatively long focal length of the object-glass employed to throw an image of the eclipsed sun on the slit.

Not until the morning after my interview with Captain Waterhouse did I learn the whereabouts of Dr. Janssen, who, from a study of the habits of the clouds and their prevailing drift, had concluded that the neighbourhood of Ootacamund was not the best that could be chosen. He had consequently taken his departure, and it seemed at first as if his whereabouts was known to no one. At last, however, Prof. Respighi and myself came upon his spoor; he was at Sholoor, on the N.E. flank of the range, at the solitary house of a tea-planter, to which there was no road, but which might be reached on ponies if a guide to it could be found. This guide Captain Sargeant, of the Revenue Department, obligingly provided, and in no very long time we reached the beautiful spot which Dr. Janssen had chosen.

It will be better that I should state his results in his own words. In a letter* to Prof. De La Rive, dated December 26, he thus writes:—

"J'ai été favorisé par un ciel d'une pureté presque absolue. Cette circonstance, et surtout les dispositions optiques toutes nouvelles que j'avais prises, m'ont permis de faire sur la couronne des constatations qui démontrent son origine solaire (pour la meilleure partie).

"Dans mon télescope,† le spectre de la couronne s'est montré non pas continu, mais remarquablement complexe. J'y ai constaté:

"Les raies brillantes du gaz hydrogène qui forme le principal élément des protubérances et de la chromosphère.

"La raie brillante verte déjà signalée aux éclipses de 1869 et 1870, et quelques autres plus faibles.

"Des raies obscures du spectre solaire ordinaire, notamment D. Ces raies sont beaucoup plus difficiles à apercevoir.

"Mes observations prouvent que, indépendamment des matières cosmiques qui doivent exister dans le voisinage du Soleil, il existe autour de cet astre une atmosphère très étendue, excessivement rare, à base d'hydrogène.

"Cette atmosphère, qui forme sans doute la dernière enveloppe gazeuse du Soleil, s'alimente de la matière des protubérances, lancée avec une si grande violence, des entrailles de la photosphère. Mais elle se distingue de la chromosphére et des protubérances, par une densité énormément plus faible, une température moins élevée, et peut-être par la présence de certain gaz différents.

"Il y a donc lieu de distinguer cette nouvelle atmosphère solaire. Je propose de la nommer *atmosphère coronale*, désignation qui rappelle que c'est elle qui produit la meilleure partie des phénomènes lumineux qui ont été désignés jusqu'ici sous le nom de couronne solaire.

"En annonçant ce résultat, je n'oublie pas, quant à moi, tout ce que nous devons aux travaux qui l'ont préparé, notamment ceux des astronomes américains aux éclipses de 1869 et 1870."

It will be seen that the importance of the brilliancy of the image, so strongly insisted upon by the Eclipse Committee in their Instructions, had been fully recognised by Dr. Janssen, whose instrument had more light even than those used by the British parties, who used "Browning With" reflectors of 9¼ inches aperture, and some 6 feet focus.

Although my account, in this place and at this time can only be of the most general character, the coincidence obtained by Janssen, Respighi, and myself on one point may be briefly referred to, namely, the distinct proof obtained by each of us that above the most vivid chromospheric layer, and even the prominences, we have hydrogen with its most familiar bright lines, and with much of the "structure" of its spectrum; these proofs being derived not only from the old method of inquiry, but from the new one employed by Professor Respighi and myself.

We spent the remainder of the day at Sholoor in mounting the hill at the back of the house to see the observatory, and to admire the wonderful view of the plains of Mysore, which was visible between a break in the hills; while the immediate neighbourhood, with its water-

* Bibliothèque Universelle, January 15, 1872, p. 103.

† Ce telescope a une ouverture de $0^m 37$, et $1^m 42$ seulement de distance focale. Les images y sont de 12 à 16 fois plus lumineuses que dans une lunette astronomique ordinaire. Le spectroscope avait été construit pour utiliser toute cette lumière.

falls, massive peaks, rocks here, and patches of wood there, steep ravines and tea-clad valleys, presented us with a scene of perfect beauty.

Next morning we were away before sunrise on our way to Mr. Pogson, whom we found at the Madras Observatory, preparing to exchange time signals with the Jaffna party. Three photographs were taken by Mr. Pogson at Avenashi, but the instrument used was so different from those used at Bekul and Dodabet (not to mention Jaffna) that it is difficult to institute a comparison in the time at my disposal; but it is not to be doubted that they will be of the highest importance when the general results come to be discussed. Mr. Pogson was assisted in the observations by his son and Mr. Chisholm, the Government architect, who was highly successful in sketching the corona and the eclipse effects upon the landscape.

Come we last to Jaffna. In my former article I referred only to the polariscope and spectroscope work done there. I have since learned that six photographs were taken with the sister instrument to the one used at Bekul.

The observations, in fact, were a perfect success. The morning was clear and bright, and could not have been finer had any one so wished.

At about six o'clock the party and those who were to assist them began to assemble on the Belfry Bastion in the Fort. Capt. Tupman observed with a polariscope and drew during the eclipse, and was assisted by Capt Varian of the *Serendib* as his time-keeper; Mr. Lewis with his telescope and polariscope was stationed inside the hut, with the photographic party, and Mr. Thwaites, Deputy Queen's Advocate, who was assisted by the carpenter of the *Serendib*. Capt. Fyers, R.E., with the spectroscope, had for his assistant Mr. W. S. Murray, Deputy Fiscal; and Capt. Hogg, R.E., who presided over the photographic department, was assisted by Mr. Twynam, Government agent, and Mr. J. W. Simpson. By these observers the polariscope results were arrived at, a telegraphic summary of which I quoted in my last communication. Six photographs were taken, being one more than we obtained at Bekul; and in the clockwork-driven integrating spectroscope the reversal of the dark lines was seen at the beginning of totality, and the hydrogen bright lines and 1474 during totality. No information yet about intensities.

Sketches were made by Mr. Foenander, of the Surveyor-General's Department, Colombo; Mr. Pargiter, Assistant Government Agent; Mr. Vine, M.C.E., of the Public Works Department; Mr. Carmichael and Mr. Layard of the O.B.C.

The crowd of natives round the Belfry Bastion was very great; they set up a most hideous howl directly totality commenced, fancying that the end of the world was at hand. They were under the impression that the whole of the Expedition with assistants and all here during the eclipse were going to get into a balloon and off to the sun and not return.

It will thus be seen that the hopes of those interested in the various expeditions of this year have not been disappointed. The composition and structure of a part of the corona have been for ever set at rest, while we have seventeen photographs, taken by instruments of the same power and pattern, to compare with each other—eleven taken at the ends of a base line some 400 miles long, and six at an intermediate elevated point, whereby it was hoped to test the influence of the atmosphere on the observed phenomena. Whether the slight mist will have prevented this or not remains to be proved; but anyhow here is a wealth of records unequalled before, and we may hope to learn much of the outer coronal regions from their comparison, not only *inter se*, but with Mr. Holiday's admirable drawings, showing considerable changes, which have also come to hand.

J. NORMAN LOCKYER

THE ADMIRALTY MANUAL OF SCIENTIFIC INQUIRY

A Manual of Scientific Inquiry; Prepared for the Use of Officers in Her Majesty's Navy and Travellers in General. 4th Edition. Superintended by the Rev. Robert Main, M.A., F.R.S., Radcliffe Observer at Oxford. Pp. 392. (John Murray, 1871.)

IN one of the earlier numbers of the *Philosophical Transactions* may be found a long list of observations proposed to be made by travellers who were about to visit the Peak of Teneriffe. Athanasius Kircher, in his *China Illustrata*, had given an account of such great marvels, that the less credulous, even of those days, wondered and almost doubted; and it was thought to be of advantage to know whether unicorns and dragons really did exist in foreign parts, whether diamonds grew, and what was the precise nature of that "poyson which turneth a man's bloud to gelly." Long afterwards the Royal Society issued instructions for the Antarctic Expedition, hints for collecting information in China, and a book entitled "What to Observe," but there was no general manual for the use of observant travellers, directing them specially not only what to observe, but how to observe. In 1849 the Lords Commissioners of the Admiralty, conceiving that "it would be to the honour and advantage of the Navy, and conduce to the general interests of Science, if new facilities and encouragement were given to the collection of information upon scientific subjects by the officers, and more particularly by the medical officers, of Her Majesty's Navy when upon foreign service," gave orders for the compilation of "The Admiralty Manual." The work was originally edited by Sir John Herschel, and was divided into various sections, each the work of some competent authority.

The work is divided into four parts. The first includes astronomy, hydrography, and tides; the second terrestrial magnetism, meteorology, atmospheric tides; the third geography, statistics, medical statistics, ethnology; and the fourth geology, mineralogy, seismology, zoology, botany. In this last edition all the articles are brought *en rapport* with the progress of science since 1849; the article on tides by Dr. Whewell is revised by the present editor of the book; the articles on statistics, medical statistics, ethnology, geology, mineralogy, botany, have also been revised by other than the original authors. There are two capital maps, the one to illustrate hydrographic delineation; the other to show the approximate limits of the great currents and drifts of the ocean.

The Astronomy (by the Astronomer Royal) is the shortest article in the book, extending over no more than 12 pages. Hydrography, on the other hand, occupies 49 pages, and contains much useful information regarding soundings, the discovery of land, sailing directions, and artificial harbours. The directions are essentially practical and eminently suggestive; thus, take the following from *Approaching a coast*:—"Always bear in mind that no description can equal a tolerably faithful sketch, accompanied by bearings. In all four sketches take angles roughly with a sextant between objects at the extremities of four drawings, and two or more intermediate ones, and affix them to the objects of the moment, and have at least one angular height in the picture; let that be of the highest and most conspicuous or best defined object."

The article on Tides (26 pages) gives minute directions for tide observations and the construction of curve tables. The next section, on Terrestrial Magnetism, by Sir Edward Sabine, is of great importance, and describes the methods of observation most in vogue; the observations of local attraction, of vibration, of deflection, and so on. We miss, however, any account of the magnetism of iron ships, and the elimination of the compass error caused thereby. Also we feel assured that simple instructions for travellers as to the use of compasses on land, in the midst of forests, &c., would prove of much service. Under the heading Meteorology we find directions for observing systematically a large number of aerial phenomena, water-spouts, bull's-eye signals, showers of dust and ashes, cyclones, various electrical manifestations, &c. Passing over the articles on atmospheric waves and barometric curves, we come to that on Statistics, which is of very general interest, and relates to the state of education and crime of a people, the manufactures, commerce, currency, revenue, municipal regulations, &c. This is followed by "Medicine and Medical Statistics," regarding the various fevers and other diseases to which travellers are specially exposed, with hints for determining the geographical distribution of diseases.

The chapter on Ethnology by the late J. C. Prichard, revised by Mr. E. B. Tylor, is to be specially commended to the notice of travellers; under the term he includes "all that relates to human beings, whether regarded as individuals, or as members of families or communities;" the physical and social history of man. This chapter is divided into three parts:—(1) of the Physical Character of Nations; (2) Characteristics of the state of Society, &c.; (3) Language, Poetry, Literature. We are lamentably deficient in our knowledge regarding the earlier history of the physical sciences, and are glad to find that Mr. Tylor alludes to the acquirement of knowledge of this nature in the following paragraph:—"The crude notions entertained by uncivilised races on subjects within the scope of physical science are matters worthy of inquiry. Science they can hardly be said to possess, though this was scarcely true with the ancient Mexicans. All nations observe the changes of the moon, and measure the lapse of time with a greater or less degree of accuracy by the movements of some of the heavenly bodies. The special names given to the months, if any, should be recorded. Inquiry should be made whether the motions of the planets are observed, and whether these bodies are distinguished from fixed stars; what ideas are current as to the conformation of earth and sky and the cause of eclipses; whether attempts are made to ascertain the duration of the solar year, whether there are names for the constellations, and what they are if they exist."

Of the remaining portions of this work we need only allude to that devoted to "Seismology, or Earthquake Phenomena," by Mr. Robert Mallet, which contains many details as to the observation of effects of rare occurrence in these latitudes, but to the traveller in South America the suggestions would be invaluable. Thus we have an account of instruments for observing the velocity and direction of the shock of an earthquake, observations to be made in a city affected by an earthquake, and the preparation of coseismal and meizoseismal curves. To conclude: the whole work is wonderfully suggestive, not alone to the traveller, but to the home observer; it teaches us to arrange in order and systematise our observations, and in so doing conveys a great deal of collateral information.

G. F. RODWELL

OUR BOOK SHELF

Gmelin-Kraut's Handbuch der Chemie, Anorganische Chemie. In Drei Banden, Sechste umgearbeitete Auflage. Herausgegeben von Dr. Karl Kraut, Heidelberg. Erster Band zweite Abtheilung, pp. 176. (London: Williams and Norgate.)

IT is now eighteen years since the appearance of the fifth edition of this work; this, of course has necessitated the change from the old atomic weights to the new, but the arrangement of the elements and sections of the book has been retained as in former editions. The present volume has been thoroughly revised, the information having been brought up to a very recent date; should the remaining volumes be equally reliable, it will probably be the most complete work on inorganic chemistry in any langauge. Dr. Kraut has obtained the assistance of Drs. Naumann, Ritter, and Jorgensen, in order to expedite the conclusion of the work. There is no book to our knowledge which contains so large an amount of information in a small space as Gmelin's Handbook. It is, as expressed in the preface, a complete, concise, and systematic handbook of chemistry up to the latest time. The merits of this book for the purposes of reference are so well known that it would be quite superfluous to enter into any lengthened description of it. In the volume now under consideration oxygen, hydrogen, carbon, boron, phosphorus, and sulphur, with some of their more important compounds, are treated of; the article on ozone and its properties is perhaps typical of the book, it occupies fourteen pages, and forms a very valuable and complete history of this body. The completion of the book may be looked for with interest, although necessarily it will be some time before this can be accomplished.

Astronomical Phenomena in 1872. By W. F. Denning, Hon. Sec. of the Observing Astronomical Society. (London: Wyman and Son.)

THIS brochure consists of some general remarks on astronomical observing, and some forty pages of data almost entirely taken from the "Nautical Almanack" for 1872. The former are addressed to the simplest tyro, and are so meagre as to give the impression of a want of accurate knowledge. In the section touching upon instruments we are told that "with regard to the spectroscope, micrometer, and other astronomical appliances, it will be better to say but very little." Accordingly very little is said, and that little is unimportant. Speaking of objects, Mr. Denning startles us with the announcement that "Comets are not interesting objects in a telescope" (we should like to hear upon what experience he grounds this assertion); and he deals with the hypothetical plant Vulcan by naïvely telling his disciples that when a total eclipse of the sun "is in progress, the region of the heavens in the immediate vicinity of the solar orb should be subjected to very careful scrutiny." For such untutored gazers as are addressed in the earlier pages the data in the later sections are insufficient There are no times of rising and setting of the moon and planets, no positions of Jupiter's satellites at times of eclipse, no information upon the points on the moon's limb at which occulted stars will disappear and reappear, no warning of the effects which change of geographical position will produce in some phenomena which are computed for Greenwich only. Altogether the book is a very weak production. J. C.

Die Arachniden Australiens nach der Natur beschrieben und abgebildet, von Dr. L. Koch. Erste Lieferung. Pp. 56. Plates iv. (Nurnberg, 1871.)

DR L. KOCH intends in this work to describe the spiders of Australia, not confining himself apparently to the large insular tract that generally passes under this name, but taking in also the Viti Islands, the Friendly, Pelew, and other groups. In his Preface to this, the first portion of his work, he says that though he has with much care and industry for twenty years observed the Arachnida of a little circuit of not more than from four to five hours walk, yet every year there comes to light within this small compass some new species that had up to then remained concealed; indeed it often happened that each little journey increased the number of forms known in the district. How true this observation is every investigator will feel; but knowing and feeling it, what courage does it not require to set to work to write the history of the spiders of a district which itself is not even yet half explored; and when the spiders are done, we are promised another work on the Myriapods. Such courage deserves to succeed, and we wish the enterprise every prosperity. The work will be published at intervals of two months, and be completed in two years; each bi monthly part will contain four plates and some five sheets of text.

Following the families and genera as laid down by Thorell in his "European Spiders," L. Koch commences with the Epeiridæ, and describes six new species of the interesting genus *Gasteracantha*. Here as in the other genera, the new species are well figured by the author in quarto plates. It is to be observed that some of the species described are not to be met with, at least have not at present been met with, in any part of Australia, but are introduced into this work by the head and shoulders as it were thus :—*G. violenta* comes from New Guinea, and *G. hepatica* from Java. Two new genera, *Tholia*, with three species, and *Anepsia* for *Epeira rhomboides*, L.K., are given. Ten new species of the genus *Argiope* are described, and three new species of *Cyrtarachne*. The diagnoses of the new genera are very properly given in Latin, and the work may be regarded as quite indispensable to all those engaged in the study of the spiders. W.

LETTERS TO THE EDITOR

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

Change of Habits in Animals and Plants

SOME weeks since I sent a few notes on *Nestor notabilis*,* showing a curious change in the history of this mountaineer. I now beg to add an extract from the *Otago Daily Times*, in confirmation of this strange story of the progressive development of change in the habits of the Kea, from the simple tastes of a honey-eater to the savageness of a eater of flesh :—

"Some time ago we mentioned that Mr. Henry Campbell, of Wanaka Station, had noticed that sheep on his run were frequently attacked by birds. We are indebted to Mr. Campbell for some further information on the subject. The birds in question are of the kind called by shepherds "the mountain parrot," and the scientific name of which is *Nestor notabilis*. The Maories call it the Kea. The birds come in flocks, single out a sheep at random, and each alighting on its back in turn, tears out the wool and makes the sheep bleed, till the animal runs away from the rest of the sheep. The birds then pursue it, continue attacking it, and force it to run about till it becomes stupid and exhausted. If in that state it throws itself down, and lies as much as possible on its back to keep the birds from picking the part attacked, they then pick a fresh hole in its side, and the sheep, when so set upon, in some instances dies. When the sheep stops bleeding the birds appear to cease to attack it, though Mr. Campbell is not very clear upon this point, and thinks they attack it more for sport than hunger. For three winters back his sheep have been attacked in this way, and it was not till this winter (though he previously suspected it) that he found the birds were the offenders. Where the birds so attack the sheep, the elevation of the country is from 4,000 to 5,000 feet above the sea level, and they only do so there in winter time. On a station owned by Mr. Campbell about thirty miles distant from the other, and at the same altitude, in the same district, and where the birds are plentiful, they do not attack the sheep in that way. For those on whose stations they are an annoyance, it may be mentioned that their numbers can be kept well thinned by shooting them. If one is wounded the rest gather round, and can be shot in fives and sixes at a time."

This note is interesting in the face of the destructive influence commonly exerted by *introduced* upon *native* life. Here we have an indigenous species making use of a recently imported aid for subsistence, at the cost of a vast change in its natural habits.

In the vegetable world we meet with a change in the habit of a native species* which is somewhat analogous.

Our *Loranthus micranthus* sometimes neglects its customary supports, found often on such trees as *Melicytus* or *Melicope* (representatives of *Violarieæ* and *Rutaceæ*), for the more attractive exotics, *Cytisus*, *Cratægus*, the plum, and the peach. Such change in its habits this fragrant parasite acquires at the cost of deserting the interlaced boughs of tangled gully for a more conspicuous position in the trim shrubbery or cultivated garden. At this time I can see a most vigorous specimen of *L. micranthus* growing on *Cytisus laburnum*, covered with countless panicles of perfume-laden blossoms, on which our introduced bee is luxuriously regaling. Here we have the foreign bee gathering sweets from native flowers growing on an exotic tree.

In this neighbourhood the laburnum was first planted, I believe, by myself, in 1859, and the bee introduced about the same time.

Ohinitahi, Oct. 7, 1871 THOMAS H. POTTS

A Case of Stationary Wave on a Moving Cord

IT is well known to mathematicians that a stretched cord, moving lengthwise with a velocity bearing a certain relation to its tension and weight, will retain any curvature which may be impressed upon it; and consequently would pass through a crooked tube without pressure against its sides. That this may be the case, the velocity, V, must equal $\sqrt{\frac{T}{M}}$; T being the tension, and M the weight of the cord per unit of length.

Passing from a stationary curve on a moving cord to one moving along a fixed cord, it is easy to see that this velocity, V, must be that of the transmission of a transverse vibration; and from this immediately follows the formula for the times of vibration of stretched strings.

The case of the stationary wave, however, though simple in theory, is rarely practically realised; and I think a short notice of a case in which it is constantly produced may not be without interest.

In Captain Dennet's admirable invention for saving life from shipwrecks, a rocket is employed having a light line attached to it. This line is previously "faked down" on two rows of pins in a box; and, the pins being withdrawn, it remains in a series

* See NATURE, vol. iv., pp. 489, 506.

* See Trans. New Zealand Institute, vol. iii., p. 190.

of zigzags which yield without entanglement to the very rapid motion of the rocket—the strain on the cord being only due to its inertia. As then the force required to set it in motion is proportional to the weight of cord moved multiplied by its velocity, and this weight is also proportional to its weight per unit of length multiplied by the velocity, the strain or tension, $T = MV^2$ or $V = \sqrt{\frac{T}{M}}$; the relation which we have already seen is necessary to the production of a stationary wave. Accordingly, we find that the rope, instead of at once following the flight of the rocket, rises almost perpendicularly from the box, and only passes into its low trajectory at a distance of six or eight feet, with a sharp irregular curve, which remains comparatively steady during the whole flight of the rocket. This curve is no doubt first produced in the first portion of the rope, which is "faked down" on the ground outside the box; but it would be impossible to see its formation, because of the smoke of the discharge, even if the motion were not too rapid.

One rather curious result of the above-mentioned conditions is, that however erratic the flight of the rocket may be, the rope will continue to follow through the whole track, as if the air were a solid which the rocket had pierced.

Another result is, that no lateral vibrations can be propagated along a rocket line—a fortunate condition with regard to steadiness of flight. HENRY R. PROCTER

Clementhorpe, North Shields, Jan. 26

Ocean Currents

PROF. EVERETT has evidently misapprehended what I said in my letter to NATURE, January 11. Nine foot-pounds would, of course, generate in a pound of matter a velocity equal to that acquired by the pound falling through a space of nine feet. And in reference to the deflecting power of rotation, what I meant was not the amount of deflection in a given space passed over, but the positive amount, say in feet, in a given time.

Edinburgh, Jan. 27 JAMES CROLL

ON TEACHING GEOLOGY AND BOTANY AS PARTS OF A LIBERAL EDUCATION

ON Monday, Jan. 22, one of a series of lectures on Educational questions was given at the rooms of the Society of Arts by Mr. J. M. Wilson, of Rugby. The following may be taken as an abstract of the lecture :—

Two points have to be considered : (1) When, if at all, these Natural History Sciences ought to be introduced into schools ; (2) What they should include, and how they should be arranged for teaching purposes.

The problem before schoolmasters is to adjust the rival claims of the subjects which press for admission into the school course, all of which may urge something in their favour. These subjects have increased in number and extent so that the question of re-arrangement is pressing. For the solution at present is to admit a little of all, or nearly all ; and the effect of this is to distract. A wide education levels up, but also levels down, and weakens, by eliminating the close study of detail, and the drudgery that is essential in valuable work. It is that conflict between the old theory of *promise* and the new theory of *performance* ; and schools are in great danger of giving less faculty than they did formerly, though they give increased knowledge.

To meet the requirements some *stratification* of studies must be effected, so that not so many shall be followed at once. Greek and Chemistry and Physics (except Mechanics), should be excluded from the elementary course, which should include Latin, French, Arithmetic, and Natural History. Then bifurcation should begin ; the one branch leading to Greek and a mainly literary education, the other to Science; both continuing Latin and English, and French and History. The recognition of the bifurcation, both by the Universities and by the great schools, is urgently needed. Without it Science must be dwarfed or excluded, and literature also suffer from the distraction which is already felt at schools. The programme of the reformers in education ought to include the abolition of Greek as a compulsory subject at the Universities.

By Natural History is meant what Huxley has introduced to us under the word "Erdkunde." The earth, its relation to sun and moon, the phenomena of day and night, and seasons ; the changes going on, the activities of the earth rain, and rivers, and sea, and earthquakes, and slow changes of level, and their geological effects, and something also of geology proper. The teaching should be based on the familiar knowledge of the boys, and should extend and systematise it, and without being too dogmatical, should be practical where possible. A little botany, enough to teach the objects and the interests of the science, and the principles of structure and classification, and something of geographical distribution, may well be included in the natural history of this elementary stage in education. The object of the master should be to discover and train scientific ability, as well as to give scientific information, and for this purpose these studies have great advantages. The bearing of the experience gained at Rugby on these questions was also given.

THE SURVIVAL OF THE FITTEST

LAST summer a discussion took place in your pages on the expression, "Survival of the Fittest," and on the principle it formulates. Though, as being responsible for this expression, there seemed occasion for me to say something to dissipate the errors respecting it, I refrained from doing so, for the reason that the rectification of misstatements and misinterpretations is an endless work, which it is almost useless to commence.

In your last number, however, the question has cropped up afresh in a manner which demands from me some notice. A Professor is tacitly assumed to be an authority in his own department; and a statement made by him respecting the views of a writer on a matter coming within this department, will naturally be accepted as trustworthy. Hence it becomes needful to correct serious mistakes thus originating.

In your abstract of Prof. E. D. Cope's paper, read before the American Association for the Advancement of Science, I find the following sentences :—

"This law has been epitomised by Spencer as the 'Preservation of the Fittest.' This neat expression, no doubt, covers the case, but it leaves the origin of the fittest entirely untouched."

There are here two misstatements, the one direct and the other indirect, which I must deal with separately.

So far as I can remember, I have nowhere used the phrase, "Preservation of the Fittest." It is one which I have studiously avoided ; and it belongs to a class of phrases for the avoidance of which I have deliberately given reasons in "First Principles," sec. 58. It is there pointed out that such expressions as "Conservation of Force," or "Conservation of Energy," are objectionable, because "conservation" implies a conserver, and an act of conserving—implies, therefore, that Energy would disappear unless it was taken care of ; and this is an implication wholly at variance with the doctrine enunciated. Here I have similarly to point out that the expression "Preservation of the Fittest" is objectionable, because in like manner it supposes an act of preserving—a process beyond, and external to, the physical processes we commonly distinguish as natural ; and this is a supposition quite alien to the idea to be conveyed. One of the chief reasons I had for venturing to substitute another formula for the formula of Mr. Darwin, was that "Natural Selection" carries a decidedly teleological suggestion, which the hypothesis to be formulated does not in reality contain ; and a good deal of the adverse criticism which the hypothesis has met with, especially in France, has, I think, arisen from the misapprehension thus caused. The expression, "Survival of the Fittest," seemed to me to have the advantage of suggesting no thought beyond the bare fact to be expressed; and this was in great part, though not wholly, the reason for using it.

Prof. Cope's indirect statement, that I have said nothing to explain "the origin" of the fittest, is equally erroneous with his direct statement which I have just corrected. In the "Principles of Biology," sec. 147, I have contended that no "interpretation of biologic evolution which rests simply on the basis of biologic induction, is an ultimate interpretation. The biologic induction must be itself interpreted. Only when the process of evolution of organisms is affiliated on the process of evolution in general, can it be truly said to be explained. . . . We have to reconcile the facts with the universal laws of re-distribution of matter and motion." After two chapters treating of the "External Factors" and "Internal Factors," which are dealt with as so many acting and re-acting forces, there come two chapters on "Direct Equilibration" and "Indirect Equilibration"—titles which of themselves imply an endeavour to interpret the facts in terms of Matter, Motion, and Force. It is in the second of these chapters that the phrase "Survival of the Fittest" is first used; and it is there used as the most convenient physiological equivalent for the purely physical statement which precedes it.

Respecting the adequacy of the explanation, I, of course, say nothing. But when Prof. Cope implies that no explanation is given, he makes still more manifest that which is already made manifest by his mis-quotation—either that he is speaking at second hand, or that he has read with extreme inattention. HERBERT SPENCER

Athenæum Club, Jan. 29

* By way of correcting a further misapprehension of Prof. Cope, I may here point out that this conception, in its less developed form, goes back to a much earlier date than the "Principles of Biology" to which he refers. In the *Westminster Review* for April 1852 (pp 498-500), I have contended that "this inevitable redundancy of numbers—this constant increase of people beyond the means of subsistence," necessitates the continual carrying-off of "those in whom the power of self-preservation is the least:" that all being subject to the "increasing difficulty of getting a living which excess of fertility entails," there is an average advance under the pressure. since 'only those who *do* advance under it eventually survive;" and these "must be the select of their generation." There is. however, in the essay from which I here quote, no recognition of what Mr. Darwin calls "spontaneous variation," nor of that *divergence of type* which this natural selective process is shown by him to produce.

THE CHANCE OF SURVIVAL OF NEW VARIETIES

AN argument first urged by the writer of an article on the "Origin of Species" in the *North British Review* for June 1867, regarding the probability of the preservation of a new modification or variety among the descendants of a plant or animal, has of late attracted much attention. It has been discussed at length by Mr. Mivart, one of the ablest critics of the Darwinian theory, and Mr. Darwin himself has, with characteristic candour, ascribed great, and as I believe undue, importance to the inferences drawn from it.

To some extent I agree with the remarks of Mr. Davis, published in your journal of the 28th December last, but I venture to think that the soundness of the argument in question has not been thoroughly tested, and that it will not bear close examination. The calculus of probabilities is a very subtle instrument, and, even in what appear to be its simpler applications, a very fallacious one, if every step in the process is not carefully considered.

The reviewer started with a seemingly simple statement of the case—"A million creatures are born; 10,000 survive to produce offspring. One of the million has twice as good a chance of surviving; but the chances are 50 to 1 against the gifted individual being one of the ten thousand (at first erroneously printed 'hundred') survivors." The fallacy here lies in the assumption that under the conditions which, according to the Darwinian theory, enable natural selection to become an efficient modifying agent, the chance of survival of a favourable modification can be correctly represented by the ratio of 2 to 1.

To avoid complication let us confine the argument to non-diœcious plants or self-fertilising lower animals. The preservation of a new variety or modification of structure depends upon two separate elements related respectively to growth and reproduction. The individual must reach maturity, and must reproduce offspring, and for each of these processes it must be able to overcome the obstacles offered by the action of other organic beings, and by external physical conditions. As a general rule we may assume that the same modification does not affect both growth and reproduction, and as the main stress of the struggle for existence turns on the dangers that affect the early period of growth, and the difficulties attendant on the production of healthy offspring, we shall sufficiently illustrate the subject in hand by considering these separately.

The chance of a modified individual growing to maturity depends upon its power of resistance to, or escape from, the various hostile agencies that surround the young animal or plant, whose combined influence is (by hypothesis) such that but one out of every hundred reaches maturity. Let us assume, for the sake of illustration, that the most important dangers to which the creature is exposed arise from physical conditions—such as excessive drought or damp—and from other organisms, as when it is the favourite food of some common animal. Now let the supposed modification affect the former relation. Let the modified organism be better fitted to resist drought; the result will be an enormous probability in favour of its escape from a danger that may destroy nine-tenths of the unmodified creatures around him, and a similar argument will apply to such a modification as would make the individual modified distasteful, or less than usually attractive, as an article of food. In point of fact, the dangers arising from external physical conditions are usually far less constant in their action than those arising from organic foes, and it is quite conceivable that even in the extreme case of a modification originating in one single individual of a species, if it were such as to give a decided advantage in that direction, the balance of probability would be in favour of survival, and in case of reappearance among numerous individuals in the next generation, have a preponderating chance of ultimate preservation.

The application of figures to measure the advantage given by a modification relating to the capacity of a species for reproduction involves no less difficulty, and may lead to the most various estimates of the probability of survival. A variation in a plant which should double the number of seeds produced without lessening their vitality, would give an advantage of 2 to 1 in the chance of producing offspring, but this, as the reviewer has shown, would not much increase the probability of the ultimate prevalence of that variety. But if the numbers of a plant were chiefly kept down by such a cause as the fruit being a favourite article of food, a modification of its flavour that would lead to some other fruit being preferred would almost certainly lead to the perpetuation of the variety with modified fruit, and not only to the rapid destruction of the unmodified form, but also to a reduction in the prevalence of some other plant.

For it must be recollected that the struggle for existence is not limited to the offspring of a single species. The rivals of each organism are all around, and the chance of survival of a new variety may be enormously increased if it be not only better able to resist hostile agencies that the unmodified form of the same species, but better than other rival organisms that may be its competitors in the struggle for existence.

I make these remarks without any desire to press the conclusion to an extreme length. I am not one of those more Darwinian than Mr. Darwin himself, who believe that the theory of Natural Selection explains everything, and has left no mysteries unsolved. I feel no doubt but that very many modifications arise that do not perpetuate themselves by the survival of a sufficient number of similarly modified individuals, even in cases where the variation may be slightly favourable; but I cannot admit the validity of an argument that goes to the very root of the principle of Natural Selection, and leads, by the appearance of exact reasoning, to a result that every naturalist feels to be absurd.

In truth, it is impossible to assign any limit to the amount of probability in favour of the preservation of a new variety. In the absence of disturbing causes affecting the equilibrium which the conditions hitherto existing in a given region tend to establish between the numbers of each species, it may be safe to assume that the probability of any new variety establishing itself is but small. But let that equilibrium be disturbed—let some hitherto unknown plants spread widely, as so many European weeds have done in Australia. This must lead to a corresponding diminution in the number of individuals of the previous vegetable inhabitants of the country, and a corresponding reduction among the animals that fed upon them. Let one of these animals be modified so as to be able to derive nourishment from the intrusive species. Is it not evident that the chance of its survival, and that of its similarly modified descendants, would be so great as to approach to certainty, unless the modification happened to bring with it other counterbalancing disadvantages?

JOHN BALL

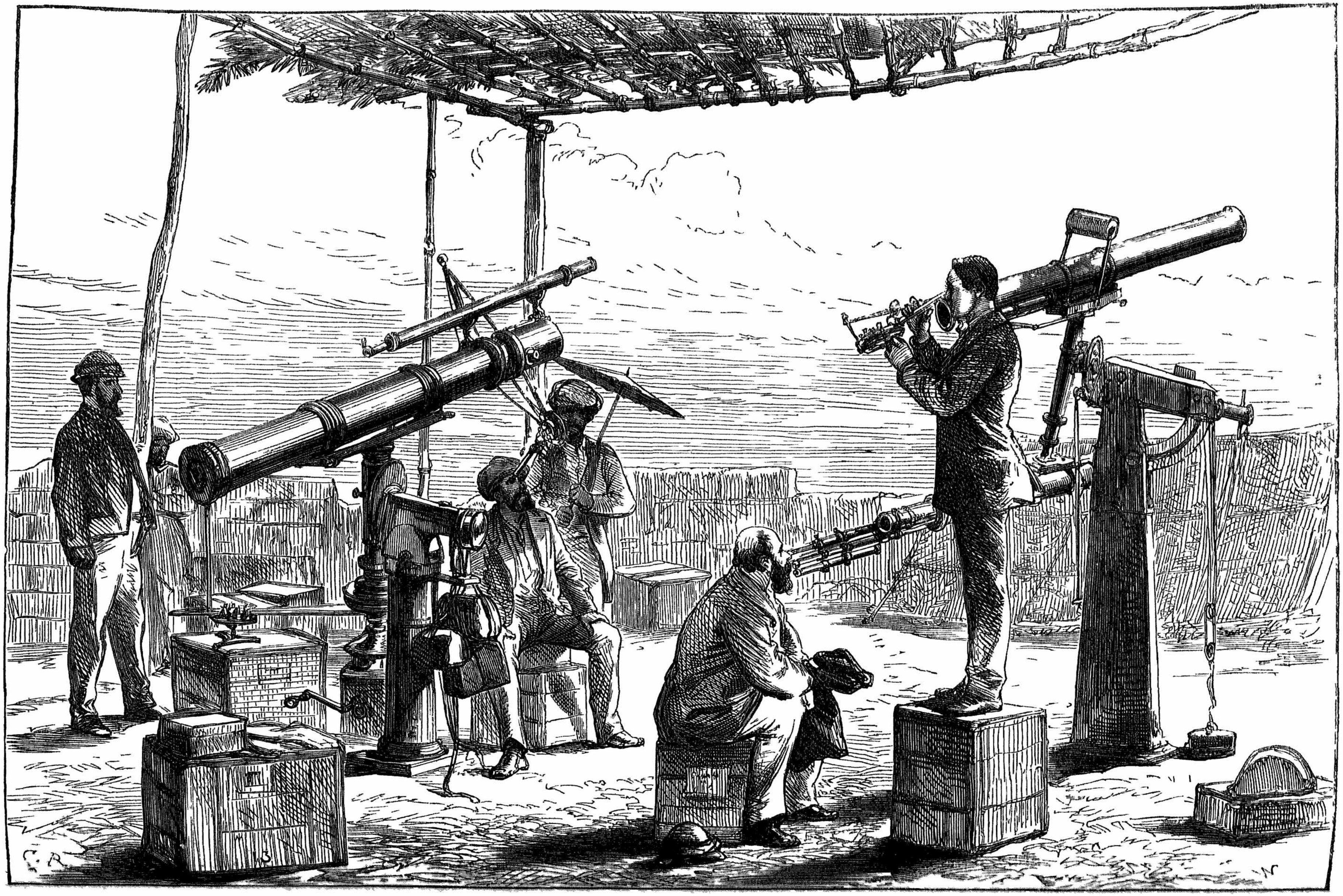
THE USE AND ABUSE OF COMPLIMENTARY NAMES

THOSE whose fortune it is to work in some particular branch of science which has not been by any means exhausted, and to encounter daily some new form from an unexplored region which seems to warrant recognition as a new species, are often in difficulty to obtain a suitable name, one which shall distinguish the new species from its congeners, or give indication of one of its most prominent characteristics. It would seem that some (I fear many) are not so fully impressed as they should be with the importance of giving appropriate specific names to new species. "Trivial" names is in many cases an accurate designation. When a new name has to be given, it seems to me that the first effort should be directed towards applying a name which has at least some connection with the object to which it is applied, and if possible indicate one of the features by which its specific distinction is established. In very large genera this will often be difficult, but seldom impossible, if sufficient reflection be permitted. This presupposes, of course, clear notions of what are the distinctive features of the new species, and something more than a mere superficial knowledge of its congeners. The custom of giving complimentary names has considerably increased of late years, and seems almost to have culminated in absurdity. It is never a thankful office to impute blame, or point out the failings of others, and I should never have ventured to draw attention to this subject did I not conceive that the application of complimentary specific names has become an abuse which needs to be protested against. I am willing to concede that the occasional dedication of a new species to some acknowledged authority, one who has published a monograph of the genus, or who has identified himself more or less with the subject, may be a graceful compliment; but even this should hardly supersede a name indicative of some special feature in the new species. My own feelings are in favour of wholly restricting such compliments to generic names. But wherefore should a mere collector, one who has stumbled over a new species by mere accident, by collecting everything that came in his way of a particular kind, unable perhaps even to recognise generic distinctions, be flattered by having his name attached to the new form by some one who has had all the scientific labour in examining, describing, and naming it for him? Has science no higher aim than that of scattering compliments? It must cause many a smile to pass across the countenances of the unscientific if they open a new cryptogamic flora, a monograph, or even glance through a volume of some scientific journal, to see on one page how Mr. Brown ventures to name something new in honour of his friend Mr. Robinson, and a few pages further on Mr. Robinson returns the compliment in favour of Mr. Brown; or in another case how in five or six genera, extending over as many pages, the same "indefatigable collector" is honoured by having his name as many times repeated, as if new species were only so many pegs on which compliments are to be suspended. My own experience is very much restricted to cryptogamic botany, and my remarks may be much less pertinent to other branches of natural science. Zoologists may not be addicted to such forms of flattery. Continental mycologists are certainly very great sinners in this respect. My object in drawing the attention of readers of NATURE to this subject is to protest against this "abuse of complimentary names," and to ascertain if some definite restriction cannot be placed upon this tendency to encumber our lists with an array of names which convey only one meaning, and which I would designate "flattery names." I hardly think it necessary to cite particular instances, as a question of this kind should be decided upon its merits, and without the introduction of personalities. The sceptical should make the experiment with some recent volume containing descriptions of new species. In one contingency, I think that it is not only admissible but advisable to use a complimentary name. If an author describes a species under a name which has already been adopted in the same genus, it would be very inconvenient to have the one specific name applied by two authors to different things. In such a case it is the custom for any one who may be working up and publishing a synopsis of the genus to suppress the most recent of the two specific names, and apply to it the name of the author who unconsciously fell into the error. Provided always that he recognises the species having priority of name as a valid member of the genus, there cannot be much abuse of this recognised practice, against which I have nothing to urge. It would be simple folly to make laws which there is no power but "common sense" to enforce; and no decision which I may determine upon will be binding upon any one save myself; yet I cannot but regret that any who have laboured year after year in love for their own special branch of science, often following it for its own sake alone, through many sacrifices, should be tempted to employ the knowledge they have so acquired as a means whereby to compliment their friends or flatter their inferiors, forgetful of the practical sarcasms that they are hurling at their own pursuits.

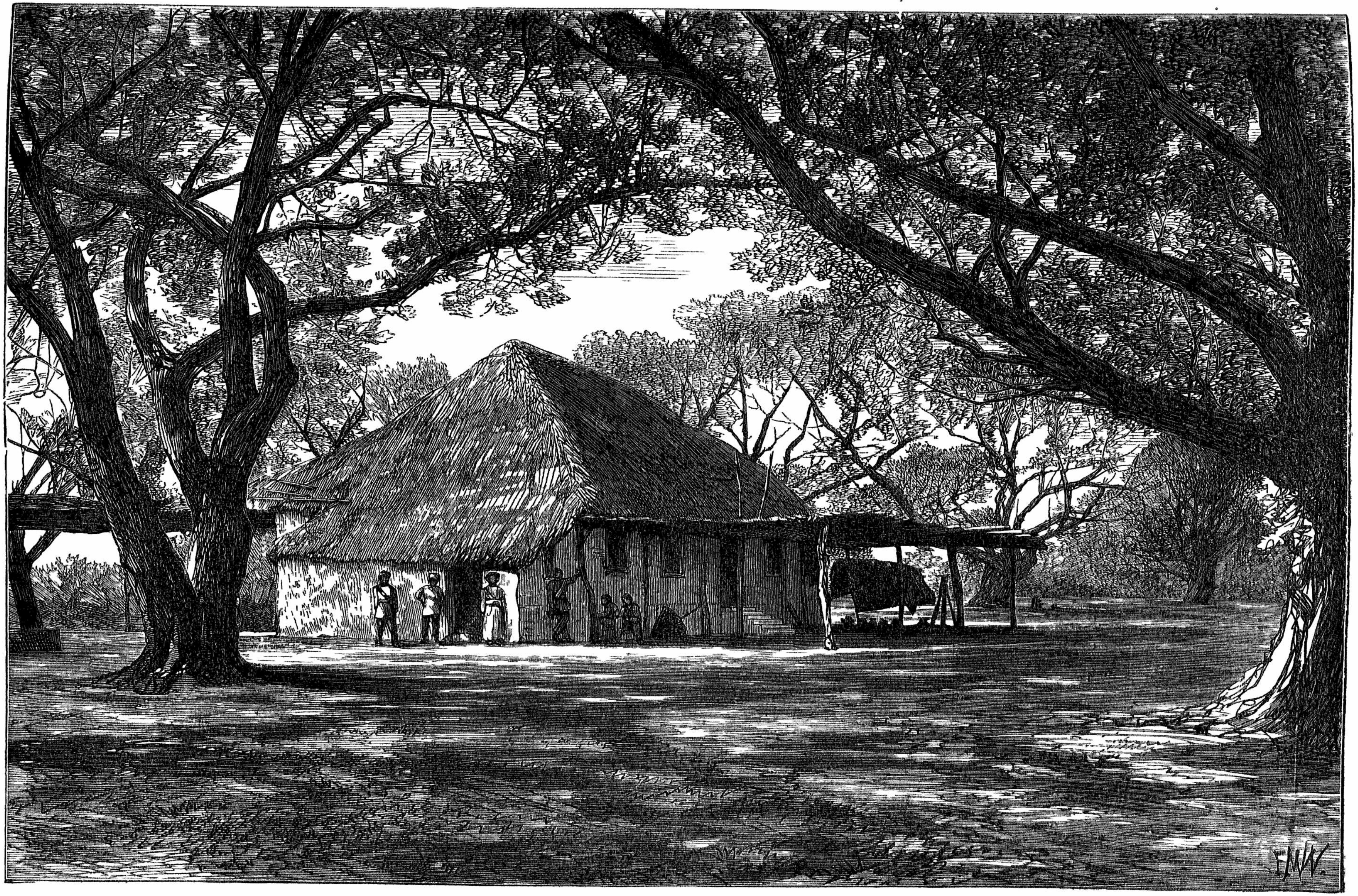
M. C. C.

THE ECLIPSE OBSERVATIONS AT BEKUL

THE illustrations which accompany this, for the loan of which we are indebted to the courtesy of the Editor of the *Illustrated London News*, are from photographs of the Eclipse party stationed at Bekul, taken by Mr. McC. Webster, the Collector of South Canara. The first represents the fort in which Mr. Lockyer and Captain



WAITING FOR THE ECLIPSE



THE BUNGALOW AT BEKUL, CANARA

Maclear had erected their instruments. Mr. Davis's photographic and Dr. Thomson's polariscopic observations being carried on at a little distance below. The instruments represented are the 9¼ reflector constructed by Mr. Browning, with a mounting by Cooke, and the double refractor, consisting of two telescopes of six inches aperture, mounted on one of the universal stands prepared for the Transit of Venus observations in 1874, and lent by the Astronomer Royal.

The second is a representation of the bungalow which formed the residence of the same party during their stay in India, erected under the friendly shelter of a grove of spreading banyan-trees. The temperature in the middle of the day at Canara reaching commonly to 90° Fahr. within doors, it will be seen how necessary was not only the shelter of the trees for their residence, but the umbrella which a native attendant is holding over the head of one of the observers during the actual time of observation.

ON THE INFLUENCE OF VIOLET LIGHT ON THE GROWTH OF VINES, AND ON THE DEVELOPMENT OF PIGS AND BULLS

GENERAL A. J. PLEASONTON, from Philadelphia, U.S., has been engaged since 1861 with some very interesting experiments on the influence of light, transmitted through violet glass, in developing animal and vegetable life. In April 1861, cuttings of vines of some twenty varieties of grapes, each one year old, of the thickness of a pipe-stem, and cut close to the spots containing them, were planted in the borders inside and outside of the grapery, on the roof of which every eighth row of glass was violet-coloured, alternating the rows on the opposite sides. Very soon the vines began to attract great notice from the rapid growth they were making. Every day the gardener was kept busy in tying up the new wood which the day before had not been observed. In a few weeks after the vines had been planted, the walls and inside of the roof were closely covered with the most luxurious and healthy development of foliage and wood.

In September of the same year Mr. Robert Buist, a noted seedsman and horticulturist, from whom the General had procured the vines, visited the grapery. After examining it very carefully, he said :—" I have been cultivating plants and vines of various kinds for the last forty years ; I have seen some of the best vineries and conservatories in England and Scotland ; but I have never seen anything like this growth." He then measured some of the vines, and found them forty-five feet in length, and an inch in diameter at the distance of one foot above the ground. And these dimensions were the growth of only five months !

In March 1862 they were started to grow, having been pruned and cleaned in January of that year. The growth in this second season was, if anything, more remarkable than it had been in the previous year. Besides the formation of the new wood, and the display of the most luxuriant foliage, there was a wonderful number of bunches of grapes, which soon assumed the most remarkable proportions—the bunches being of extraordinary magnitude, and the grapes of unusual size and development.

In September, when the grapes were beginning to colour and to ripen rapidly, Mr. Buist visited the grapery again, and estimated that there were 1,200 pounds of grapes. General Pleasonton remarks that in grape-growing countries, where grapes have been grown for centuries, a period of time of from five to six years will elapse before a single bunch of grapes can be produced from a young vine ; while here, only seventeen months after, his grapery had yielded the finest and choicest varieties of grapes.

During the next season (1863) the vines again fruited, and matured a crop of grapes, estimated, by comparison with the yield of the previous year, to weigh about two tons ; the vines were perfectly healthy, and free from the usual maladies which affect the grape. Many cultivators said that such excessive crops would exhaust the vines, and that the following year there would be no fruit ; as it was well known that all plants required rest after yielding large crops. Notwithstanding, new wood was formed this year for the next year's crop, which turned out to be quite as large as it had been in the season of 1863 ; and so on, year by year, the vines have continued to bear large crops of fine fruit without intermission for the last nine years. They are now healthy and strong, and as yet show no signs of decrepitude or exhaustion.

The success of the grapery induced General Pleasonton to make an experiment with animal life. In the autumn of 1869 he built a piggery, and introduced into the roof and three sides of it violet-coloured and white glass in equal proportions—half of each kind. Separating a recent litter of Chester country pigs into two parties, he placed three sows and one barrow pig in the white pen, and three other sows and one other barrow pig in the pen under the violet glass. The pigs were all about two months old. It will be observed that each of the pigs under the violet glass was lighter in weight than the lightest pig of those under the sun-light alone in the white pen. The two sets were treated exactly alike; fed with the same kinds of food, at equal intervals of time, and with equal quantities by measure at each meal, and were attended by the same man. On the 4th of May, 1870, the six sows, being weighed, the following conclusion was obtained : –

	Under the violet pens.	Under the white pens.
November 3. 1869 ...	122 lbs. ...	144 lbs.
March 4, 1870 ...	520 lbs. ...	530 lbs.
Increase...	398 lbs. ...	386 lbs.

Consequently, although the pigs placed under the violet pens actually weighed 10 lbs. less than those under the white pens ; yet, taking into consideration the 22 lbs. less which the first pigs had previously weighed, there is an actual gain of 12 lbs. The two other barrow pigs offered nearly the same result.

The next experiment of General Pleasonton was with an Alderney bull calf, born on Jan. 26, 1870. At its birth it was so puny and feeble that the man who attends upon his stock—a very experienced hand—told him that it would not live. He directed him to put it in one of the pens under the violet glass. In 24 hours a very sensible change had occurred in the animal. It had arisen on its feet, walked about the pen, took its food freely by the finger, and manifested great vivacity. In a few days his feeble condition had entirely disappeared. It began to grow, and its development was marvellous. On March 31, 1870, two months and five days after its birth, its rapid growth was so apparent that, as its hind quarter was then growing, he had it measured. Fifty days afterwards it had gained six inches in height, carrying its lateral development with it. The calf was turned into the barn yard, and manifested every symptom of full masculine vigour, though at the time he was only four months old. He is now one of the best developed animals that can be found anywhere.

This is only a very short *résumé* of the third edition of a pamphlet published by General Pleasonton, entitled, " On the Influence of the Blue Colour of the Sky in Developing Animal and Vegetable Life : as Illustrated in the Experiments of the Author between the years 1861 and 1871 " (Philadelphia, 1871). 8vo. 24 pp.

The account of it which I had addressed to the French Academy was followed by two different notes from Cailletet and Bert. In my next article I will examine them, with some references to the explanation of General Pleasonton's experiments.

Paris, Jan. 10 ANDRÉ POËY

MAGNETIC DISTURBANCES DURING THE LATE TOTAL ECLIPSE

In the list of papers read before the Paris Academy of Sciences, which was given in last week's NATURE, I noticed one on the magnetic perturbations observed at Alençon during the late total eclipse. Now it would at first sight appear reasonable to expect that any effect produced on the magnetic needle at Alençon by a phenomenon whose maximum phase was as far removed as India or Australia, should have nearly equal effect on the needle in England, and in all countries adjoining France. It has moreover been established by frequent comparisons of carefully measured photographic records, taken at different magnetic observatories, that any disturbance of the earth's magnetic force is felt almost simultaneously at stations differing several hundred miles in both latitude and longitude. I was, therefore, justified in supposing that I should find some indications on our photo-magnetic records of a disturbance corresponding to the perturbations of the needle at Alençon, alluded to by M. Lion in his note to the Academy. The result of my examination of the records is, that there is not the slightest trace of a disturbance on either the vertical or horizontal curves, and that the declination magnet has been more than usually quiet, although on the two previous days it happened to have been somewhat disturbed about the hour at which the totality of December 11 occurred.

Accidental causes influence too largely the readings of a declination magnet for much reliance to be placed on them, however careful the observer, when they are in open contradiction to the photo-records of instruments whose diurnal corrections are sensibly constant.

Stonyhurst Observatory, Jan. 28 S. J. PERRY

SCHOLARSHIPS AND EXHIBITIONS FOR NATURAL SCIENCE IN CAMBRIDGE, 1872

The following is a list of the Scholarships and Exhibitions for proficiency in Natural Science to be offered in Cambridge during the present year :—

TRINITY COLLEGE.—One or two of the value of about 80*l.* per annum. The examination will be on April 5, and will be open to all undergraduates of Cambridge and Oxford, and to persons under twenty who are not members of the Universities. Further information may be obtained from the Rev. E. Blore, Tutor of Trinity College.

ST. JOHN'S COLLEGE.—One of the value of 50*l.* per annum. The examination (in Chemistry, Physics, and Physiology, with Geology, Anatomy, and Botany) will be on the 12th of April, and will be open to all persons who are not entered at the University, as well to all who have entered and have not completed one term of residence. Natural Science is made one of the subjects of the annual College Examination of its students at the end of its academical year, in May ; and Exhibitions and Foundation Scholarships will be awarded to students who show an amount of knowledge equivalent to that which in Classics or Mathematics usually gains an Exhibition or Scholarship in the College. In short, Natural Science is on the same footing with Classics and Mathematics, both as regards teaching and rewards.

CHRIST'S COLLEGE.—One or more, in value from 30*l.* to 70*l.*, according to the number and merits of the candidates, tenable for three-and-a-half years, and for three years longer by those who reside during that period at the College. The examination will be on March 19, and will be open to the undergraduates of this College; to non-collegiate undergraduates of Cambridge; to all undergraduates of Oxford ; and to any students who are not members of either University. The candidates may select their own subjects for examination. There are other Exhibitions which are distributed annually among the most deserving students of the College.

CAIUS COLLEGE.—One of the value of 60*l.* per annum. The examination will be on March 19 in Chemistry and Experimental Physics, Zoology with Comparative Anatomy and Physiology, and Botany with Vegetable Anatomy and Physiology ; it will be open to students who have not commenced residence in the University. There is no limitation as to age.—Scholarships of the value of 20*l* each, or more if the candidates are unusually good, are offered for Anatomy and Physiology to members of the College. — Gentlemen elected to the Tancred Medical Studentships are required to enter at this College; these Studentships are four in number, and the annual value of each is 113*l.* Information respecting these may be obtained from Mr. B. J. L. Frere, 28, Lincoln's Inn Fields, London.

CLARE COLLEGE.—One or more of the value of 50*l.* per annum. The examination (in Chemistry, Chemical Physics, Comparative Anatomy and Physiology, and Geology) will be on March 19, and will be open to students intending to begin residence in October.

DOWNING COLLEGE.—One or more of the value of 40*l.* per annum. The examination (in Chemistry, Comparative Anatomy, and Physiology) will be early in April, and will be open to all students not members of the University, as well as to all undergraduates in their first term.

SIDNEY COLLEGE.—Two of the value of 40*l.* per annum. The examination (in Heat, Electricity, Chemistry, Geology, Physiology, Botany) will be in October, and will be open to all students who may enter on the College boards before October 1.

EMMANUEL COLLEGE.—One or more of the value of 40*l.* to 60*l.* per annum. The examination on March 19 will be open to students who have not commenced residence.

PEMBROKE COLLEGE.—One or more of the value of 20*l.* to 60*l.*, according to merit. The examination in June (in Chemistry, Physics, and other subjects), will be open to students under twenty years of age.

ST. PETER'S COLLEGE.—One from 50*l.* to 80*l.* per annum, according to merit. The examination, on April 4 (in Chemistry, Comparative Anatomy and Physiology, and Botany), will be open to students who will be under twenty-one years of age on October 1, 1872, and who have not commenced residence.

Although several subjects for examination are in each instance given, this is rather to afford the option of one or more to the candidates than to induce them to present a superficial knowledge of several. Indeed, it is expressly stated by some of the Colleges that good clear knowledge of one or two subjects will be more esteemed than a general knowledge of several.

Candidates, especially those who are not members of the University, will, in most instances, be required to show a fair knowledge of Classics and Mathematics, such, for example, as would enable them to pass the Previous Examination.

There is no restriction on the ground of religious denomination in the case of these or of any of the Scholarships or Exhibitions in the Colleges or in the University. Further information may be obtained from the tutors of the respective Colleges.

It may be added that Trinity College will give a Fellowship for Natural Science once, at least, in three years ; and that most of the Colleges are understood to be willing to award Fellowships for merit in Natural Science equivalent to that for which they are in the habit of giving them for Classics and Mathematics.

The following lectures in Natural Sciences will be delivered at Trinity, St. John's, and Sidney Sussex Colleges during Lent Term, 1872 :—

On Sound and Light. (For the Natural Sciences Tripos.) By Mr. Trotter, Trinity College, on Mondays, Wednesdays, and Fridays, at 10, commencing Monday, February 5.

On Electricity and Magnetism. (For the Natural Sciences Tripos, a short course in continuation of that of last term.) By Mr. Trotter, Trinity College, on Tuesdays and Thursdays, at 9, commencing Thursday, February 1.

On Electricity and Magnetism, for the special examination for the ordinary degree. By Mr. Trotter, Trinity College, on Tuesdays, Thursdays, and Saturdays, at 11, commencing Thursday, February 1.

On Chemistry. By Mr. Main, St. John's College, on Mondays, Wednesdays, and Fridays, at 12, in St. John's College laboratory, commencing Wednesday, January 31. Instruction in Practical Chemistry will also be given.

On Palæontology. (The Annuloida, &c.) By Mr. Bonney, St. John's College, on Mondays, Wednesdays, and Fridays, at 9, commencing Wednesday, January 31.

On Geology. (For the Natural Sciences Tripos. Physical Geology.) By Mr. Bonney, St. John's College, on Tuesdays and Thursdays, at 10, commencing Thursday, February 1.

A course on Stratigraphical Geology will be given in the Easter Term. Papers will be given every Saturday at 11.

Elementary Geology (for the special examination), on Tuesdays and Thursdays, at 11, commencing Thursday, February 6.

On Botany. (For the Natural Sciences Tripos.) By Mr. Hicks, Sidney College, on Tuesdays, Thursdays, and Saturdays, at 12, beginning on Thursday, February 1. The lectures during this term will be on Structural and Physiological Botany.

On the Physiology of the Nervous System. By the Trinity Prælector in Physiology (Dr. M. Foster), at the New Museums, on Mondays, Tuesdays, and Wednesdays, at 11, commencing Monday, February 5.

The Physiological Laboratory is also open for practical instruction in Physiology to all those who have gone through the elementary course.

NATURAL SCIENCE AT OXFORD

THE following regulations have been issued for the Final Honour Examination in the Natural Science School:—

BIOLOGY.—1. Candidates who offer themselves in the Final Honour Examination for examination in Biology will be expected to show an acquaintance, firstly, with General and Comparative Anatomy; secondly, with Human and Comparative Physiology, inclusive of Physiological Chemistry; and thirdly, with the General Philosophy of the subject.

2. In these subjects the candidates will be examined both by paper work and practically; and will be required to give evidence of being competent not merely to verify and describe specimens already prepared for naked-eye or microscopic demonstration as the case may be, but also to prepare such or similar specimens themselves.

3. The following works are provisionally recommended by the Board of Studies for use in the study of the above-mentioned Departments of Biology. When the letter F or G is prefixed to the title of a work, it will be understood to indicate that the work is written in French or German, and is not as yet translated into English:—

General Anatomy.—Sharpey in Quain's Anatomy, ed. 7, 1867; The Micrographic Dictionary, by Griffiths and Henfrey, now in course of re-publication; The Histological Catalogue of the College of Surgeons, by Prof. Quekett; (G) Kölliker's Handbuch der Gewebe-lehre, ed. 1867; Stricker's Handbook of Human and Comparative Histology, now in course of translation for the New Sydenham Society.

Comparative Anatomy.—Huxley's Introduction to the Classification of Animals; Huxley's Anatomy of Vertebrated Animals, 1871; (F) and (G) Gegenbaur's Grundzüge der Vergl. Anatomie, 1869; (F) Milne-Edwards, Leçons sur la Physiologie, 1857-1870; The Osteological and Physiological Catalogues of the College of Surgeons, by Prof. Owen; The Anatomical and Physiological Catalogues of the Oxford Museum; Flower's Osteology of Mammalia, 1871; (F) Cuvier's Ossemens Fossiles, ed. 2, 1821-1824; Rolleston's Forms of Animal Life, 1870; Bronn's Klassen und Ordnungen des Thierreichs, 1860-1871.

Human Physiology.—Carpenter's Human Physiology, ed. 7, 1869; (G) Funke's Lehrbuch der Physiologie, now in course of re-publication; (G) Hermann's Handbuch der Biologie, 1870; Dalton's Human Physiology; Draper's Human Physiology, 1856; (G) Ranke, Grundzüge der Physiologie, 1868; (G) Wundt's Lehrbuch der Physiologie, 1865; (G) Ludwig's Lehrbuch der Physiologie, 1858-1861; (G) Budge's Lehrbuch der speciellen Physiologie des Menschen, 1862.

Comparative Physiology.—Carpenter's Comparative Physiology, 1854; Marshall's Outlines of Physiology, 1867; (F) Milne-Edwards' Leçons sur la Physiologie; (G) Bergmann and Leuckart, Anatomisch-physiologische Uebersicht des Thierreichs, 1855.

General Philosophy of Biology.—*a.* Darwin's Origin of Species; Van der Hoeven's Philosophia Zoologica, 1864, Lyell's Principles of Geology, ed. 1870, chaps. xxxiv—xxxvii.; Mivart's Genesis of Species; Spencer's Principles of Biology, 1864-1867; Principles of Psychology, ed. 1868-1871; *b.* Agassiz's Essay on Classification, chap. iii.; Whewell's History of the Inductive Sciences (For a Historical Survey of the Progress of Biology); *c.* Van der Hoeven's Handbook of Zoology, 1857; Nicholson's Manual of Zoology, ed. 2, 1871 (For Zoology); Van der Hoeven's Philosophia Zoologica, lib. iv.; Lyell's Principles of Geology, chap. xxxviii—xli. (For Geographical Distribution).

Ethnology and Anthropology.—Waitz's Anthropology; Brace's Races of the Old World, ed. 2, 1870.

4. Candidates may, in addition to the amount of work indicated in the preceding paragraphs, bring up any of the "Special Subjects" contained in the list appended below. A candidate who offers himself for examination in a special subject will be expected to show, firstly, a detailed practical acquaintance with specimens illustrating that subject, for which purpose the catalogues in the University Museum can be made available; and, secondly, exact knowledge of some one or more monographs treating of it. Excellence, however, in a special subject will not compensate for failure in any essential part of the general examination. Every candidate must state, at the time of entering his name for examination, what special subject, if any, he takes in. List of special subjects and of books recommended in connection with them:—

Comparative Osteology.—Cuvier's Ossemens Fossiles, any one of the five volumes; Flower's Osteology of Mammalia; Prof. Huxley's Anatomy of Vertebrated Animals.

The Comparative Anatomy and Physiology of the Organs of Digestion.—The Physiological Catalogue of the Royal College of Surgeons, vol. i.; (F) Milne-Edwards's Leçons, vol. vi.; Articles "Stomach and Intestine" and "Pancreas" in Todd's "Cyclopædia of Anatomy and Physiology;" (F) Schiff, Leçons sur la Physiologie de la Digestion, 1868.

The Comparative Anatomy and Physiology of the Organs of Circulation and Respiration.—(F) Milne-Edwards's Leçons sur la Physiologie, vol. iii.; (F) Marey's Physiologie Médicale de la Circulation du Sang, 1863; (F) Bert, Leçons sur la Physiologie Comparée de la Respiration, 1870.

The Comparative Anatomy and Physiology of the Nervous System.—(F) Leuret's and Gratiolet's Anatomie Comparée du Système Nerveux, Tom. ii., par M. Pierre Gratiolet, 1857; (F) Vulpian's Leçons sur le Système Nerveux: Brown-Séquard's Lectures, 1865.

The Comparative Anatomy and Physiology of the Reproductive Systems.—Physiological Catalogue of the Royal College of Surgeons, vols. iv. and v.; (G) Kölliker's Entwickelungsgeschichte, 1861; (F) Milne-Edwards Leçons, vol. ix.

Ethnology.—Brace's Races of the Old World, ed. 2, 1870.

5. Candidates who offer themselves for examination in Geology, Zoology, or Botany will be required to exhibit practical acquaintance with those subjects to at least the same extent as candidates who offer themselves for examination in any one of the special subjects above mentioned are required to do with reference to those subjects. But they will not be required to go through the same amount of practical work in the departments of Biology not specially connected with Geology, Zoology, or Botany as candidates who do not bring up any one of these three subjects.

NOTES

The Senior Wrangler for the present year is Mr. Robert Rumsey Webb, son of the late Mr. Thomas Webb, of Monmouth. He was educated under the Rev. C. M. Roberts, M.A. (St. John's College, Cambridge), at the Monmouth Grammar School, and entered at St. John's College in October 1868, having previously obtained a Somerset Exhibition by open competition. Mr. Webb's college tutor was Mr. J. E. Sandys; his private tutor Mr Routh, of St. Peter's. Mr. Horace Lamb, the Second Wrangler, was born at Stockport, in November 1849, was educated at the Stockport Grammar School, and for a short time studied at Owens College, Manchester. In the year 1868 he gained a minor scholarship at Trinity College, and in 1870 was elected to a Foundation Scholarship. He was placed in the first class in the First B A. Mathematical Honour Examination in the University of London in 1870; and in the succeeding year gained the Sheepshanks Astronomical Exhibition at Trinity College. His college tutor was Mr. Prior; private tutor, Mr. Routh, of St. Peter's Mr. John Bascombe Lock, the Third Wrangler, son of Mr. Joseph Lock, of Dorchester, was educated at the Bristol Grammar School. In the Easter Term of 1868 he obtained an open Mathematical Scholarship at Caius College, where he obtained a Foundation Scholarship in May. Mr. Routh was his private tutor, and Mr. N. M. Ferrers his college tutor.

The following are the lectures on Science at the University of Oxford this term:—The Rev. Bartholomew Price, the Sedleian Professor of Natural Philosophy, on Light; the Savilian Professor of Astronomy, Rev. C. Pritchard, on Newton's "Principia" and the Lunar Theory; Prof. Clifton, Professor of Experimental Philosophy, on Experimental Optics; Prof. Westwood, Professor of Zoology, on the Classes and Orders of Articulated Animals; Prof. Phillips, Professor of Geology, on the Geology of the country round Oxford; Prof. Rolleston, Professor of Anatomy, on Digestion. In addition to these lectures Prof. Clifton announces that the physical laboratory of the University will be open daily for instruction in Practical Physics from 10 to 4 o'clock each day. Prof. Rolleston proposes to form classes for practical instruction as in former Terms. The Chemical Laboratory is open as usual for Quantitative and Qualitative analysis. Dr. Acland, the Regius Professor of Medicine, also announces that, in addition to his course of clinical instruction at the infirmary, he "will also on days and places to be hereafter mentioned demonstrate on the spot sanitary defects in a town and in a village, illustrating thereon principles of general and special sanitary administration." In the Laboratory of the Medical Department at the University Museum various methods of examining water and other subjects connected with sanitary science will be taught, commencing on February 1, by Mr. C. C. Pode, M.B., Exeter College, with the assistance of Mr. S. J. Sharkey, B.A., of Jesus College. Those lectures and demonstrations on sanitary matters are a novel and peculiarly-interesting feature introduced this Term for the first time.

Dr. Paget has been appointed Regius Professor of Medicine at the University of Cambridge.

The Professorship of Botany in the Royal College of Science for Ireland is vacant by the resignation of Prof. W. T. Thiselton-Dyer.

The King of Italy has conferred upon Mr. Edward Whymper, Vice-President of the Alpine Club, the decoration of Chevalier of the Order of St. Maurice et Lazare, "in recognition of the value of his recently published magnificent work upon the Alps."

We have to record the death, on Saturday last, of Dr. W. Baird, F.R.S., of the Zoological Department of the British Museum, at the age of 69.

The American Academy of Arts and Sciences on the 9th of January presented the American Rumford Medals to Mr. J. Harrison, jun., of Philadelphia, for his invention of safety boilers. The medals are provided for by an endowment fund or gift of 5,000 dols. in the United States Funds, to the Academy, made by Count Rumford in 1796. By the conditions of this endowment the interest of the fund is to be applied "every second year" to the procuring of two medals, one of gold and one of silver, in value equal to the amount of two years' interest of the fund (600 dols.), and these medals (or their equivalent in money) are to be awarded to the author of the most important discovery or useful improvement in the application of heat or light, which shall, in the opinion of the Academy, "tend most to promote the good of mankind." Although the fund was provided at that early day no discovery or improvement of sufficient importance, in the opinion of the Academy, appeared until 1859, when the first award was made to Dr. Robert Hare, of Philadelphia, for his compound oxy-hydrogen blowpipe and improvements in galvanic apparatus. Since then the awards of the medal have been as follows:—1862, John B. Ericsson for his caloric engine; 1865, Prof. Daniel Treadwell (Harvard College), for improvements in the management of heat; 1867, Alvan Clark, for improvement in lens of refracting telescope; 1870, George H. Corliss, Providence, for improvements in the steam-engine; 1871, Joseph Harrison, jun., Philadelphia, for "the mode of constructing steam boilers invented and perfected by him," which "secures great safety in the use of high-pressure steam, and is, therefore an important improvement in the application of heat"

A meeting in aid of the Livingstone Exploration Fund was held in the City of London on Tuesday last, the Lord Mayor in the chair; the subscriptions received in the room amounting to over 250*l.* Sir H. Rawlinson announced at the meeting that he had that day received from the Foreign Office a despatch which was to be presented by Lieutenant Llewellyn Dawson to the Government agent at Zanzibar, in which Dr. Kirk was instructed to give to Lieutenant Dawson all the advice and assistance in his power, and was authorised to advance any sum which might be required for the purposes of the expedition within the limit of the balance of the Government grant of 1,000*l.*, which remained in his hands, and which, according to the last account, amounted to 650*l.* He also stated that the subscriptions already received reached 2,700*l.* or 2,800*l.*

THE Second Course of Cantor Lectures for the session will be delivered by the Rev. Arthur Rigg, M. A., on "Mechanism." The first lecture will be given on Monday evening, Feb. 5, at eight o'clock, and the remainder on following Mondays till March 11.

THE *Athenæum* states that Mr. E. J. Reed, C.B., late Chief Constructor of the Navy, is about to establish a new quarterly magazine of a scientific character, the first number of which will appear early in March, to be devoted to the improvement of naval architecture, marine engineering, steam navigation, and seamanship generally. It will be called *Naval Science*, and will be under the joint editorship of the Rev. Dr. Woolley, Director of Education to the Admiralty, and Mr. Reed.

THE following are the number of entries for the classes at the Newcastle College of Physical Science for the present term:—Evening classes—chemistry, 36 (including one lady); physics, 40 (including four ladies); geology, 19; advanced mathematics, 15; elementary mathematics, 24; political economy, 12 (this class will not be held). Day classes. New entries at Epiphany term—chemistry, 8; physics, 7; mathematics, 8; geology, 3.

THE following are appointed trustees to the Alder Memorial Fund, of which we spoke last week:—Sir W. G. Armstrong, Mr. I. L. Bell, Mr. J. Blacklock, Mr. H. B. Brady, Mr. A. Hancock, Mr. D. P. Morison, Mr. R. S. Newall, and the Rev. A. M. Norman; who have received the following suggestion from the subscribers:—"That it should be suggested to the trustees that the establishment of a College of Physical Science in Newcastle appears to offer opportunities for the employment of the fund in furtherance of zoological science, more likely to be generally appreciated as a memorial of our late distinguished naturalist than the scheme originally proposed, and that in the event of the establishment of a chair of biology in the College, the application of the interest of the fund might properly take the form of a scholarship or other reward for proficiency in zoology, to be associated with Mr. Alder's name."

THE Natural History Society of Newcastle-on-Tyne has received a gift of 20*l.* from the Misses Bewick; which sum is to be applied in defraying the cost of new cabinets as they might be required. The Society has also been presented with a most valuable collection of fossils from Mr. M. R. Pryor, Fellow of Trinity College, Cambridge, consisting of about 140 species of Upper Greensand fossils from Cambridgeshire; 130 species from the Red Crag; a fine series from the Lower Greensand Coprolite Bed of the Eastern Counties; a fair representative collection from the Oxford Clay at St. Ives, Huntingdon; and a number of Chalk fossils; all admirably mounted and named.

A RESOLUTION has been presented to the Congress of the United States providing for the printing of a number of copies of the report of the investigation by Prof. Hayden upon the geology of Nebraska and Wyoming territory.

IN a letter from Government House, Barbadoes, January 6, 1872, to one of our contributors, the Hon. Rawson Rawson writes:—"Agassiz, Count Pourtales, and a party of *savans* have just left this. The United States surveying vessel in which they go to the Pacific had to put in for some slight repairs. They were here for two days and I went on board and spent one day with them. Agassiz pronounced my collection of shells quite unique in series of specimens, from the youngest stage to adult. He was in ecstacies with the *Holopus*,* which he spent hours in examining, and I had to let him take it away to describe it in all detail. He had seen and studied D'Orbigny's *H. rangii*, and thinks mine the same species, but that it is of the normal form, while the one D'Orbigny described was both incomplete and abnormal. I had Dr. Gray's sketch with me, and certainly the resemblance to it was very great. I think I may fairly regard it as the gem of my collection; but in writing of it I must not forget to tell you of our day's dredging. It was successful beyond our expectations—four live specimens of a fine new crinoid, like *Apiocrinus*, which Agassiz was able to watch alive for hours; a *Pleurotomaria Quoyana*, of which the artist was able to draw the animal; a new and wonderfully beautiful species of *Latiaxis*, Brachiopods in any number, vitreous sponges in mass, some new Echini. You can fancy the state Agassiz was in, and time would quite fail me to tell you of all the interesting things he said about the various forms as he recognised them. Need I say that all this has determined me to make an effort to get our shores dredged, beginning in shallow and going out to the depth they dredged at, *i.e.*, about forty or fifty fathoms. We shall, doubtless, get lots of treasures, upon the duplicates of which you shall have first claim."

* Vide Notes on *Holopus*. By Dr. J. E. Gray. Annals and Mag. Nat. Hist, vol. viii., 4th series, p. 394.

PROF. B. A. GOULD writes from the Argentine National Observatory at Cordoba, under date December 8, 1871, that the new observatory had then been formally inaugurated about six weeks, after a series of most unexpected and vexatious obstacles and delays. The climate had, however, proved far less propitious than had been expected, the cloudy nights being nearly as numerous as the clear ones, although no rain falls during one half the year. When, however, the sky is clear, it is of a wondrous transparency, stars of the seventh magnitude being distinctly visible on favourable nights to the naked eye, and the planets magnificent in their brilliancy. The large equatorial was already in adjustment, and Prof. Gould had had some beautiful views of Saturn. Owing to the breaking out of the epidemic in Buenos Aires at the beginning of 1871, all communication with Europe, by post or otherwise, had been almost entirely suspended during the year; faint rumours of the success of the eclipse observations in Spain in December 1870 had but just reached Cordoba.

A BLACK marble slab, bearing the following inscription in brass characters, has just been placed over the grave of the late Sir John Herschel, in the north aisle of the nave of Westminster Abbey:—

JOHANNES HERSCHEL
GULIELMI HERSCHEL
NATU OPERE FAMA
FILIUS UNICUS
"CŒLIS EXPLORATIS"
HIC PROPE NEWTONUM
REQUIESCIT
GENERATIO ET GENERATIO
MIRACILIA DEI NARRABUNT
PSALM. CXLV. 4, 5.
VIXIT LXXIX. ANNOS
OBIIT UNDECIMO DIE MAII
A D. MDCCCLXXI.

THE following account of the fall of a meteorite is taken from Gruiethuisen's "Naturgeschichte des Gestirnten Himmels:"—On July 24, 1790, at 10.30 P.M. a fiery globe larger and brighter than the full moon, as seen from Mormes, passed from S. to N. in 2 s., and burst leaving a white cloud. 3 m. after explosion the two observers heard a heavy thunder-clap that shook the windows and opened some of them. The 15 leagues distant chain of the Pyrenees gave a continuous echo lasting 4s. The fragments fell in extraordinary quantity between Juliac and Barbotan, 4 hours N. and 5 hours NE. from Mormes; they fell fused so as to bake the impression of straw, and make no sound on the roof of houses, weighing 4 "loth" to 20 "pfund." The ball of fire was seen from Bayonne, Auch, Pau, Tanbes, Bordeaux, and Toulouse, from the latter place only as something larger than a fixed star.

WE give a fuller account of the volcanic eruption at Ternate alluded to by our correspondent Mr. A. B. Meyer in NATURE for January 18. The Batavia *Handelsblad* of Sept. 25 states that on the afternoon of Aug. 7 a violent earthquake was felt, of which the exact direction was unknown. The Ternate mountain had from 9 A.M. caused a dull, rumbling sound to be heard, varied at intervals by loud reports, and began in the course of the day to cast out streams of lava. The sky looked dark, and the whole country round about was darkened by the down-coming clouds of smoke. Luckily a southerly wind sprung up, which gave another direction to the glowing lava-streams flowing landwards, and led the fire in seven currents to the ravines. This frightful natural phenomenon held on during the night between the 7th and the 8th. The inhabitants, thinking their island to be doomed, could not sleep, and passed the night outside their houses looking up anxiously at the furious volcano which seemed to threaten them all with certain destruction. At day-break the outburst became still worse, and the population began to fly to the islands of Tidore and Halmaheira. The eruption of fire and stones held on for about twelve days, after which it became less. The damage done to houses and plantations is enormous, but has not as yet been accurately ascertained. This outburst was the most violent known at Ternate within the memory of man. The whole island shook from the underground motion. A moment of rest was followed by another explosion, which shook the houses to their foundations. There were, luckily, only some slight earthquake-shocks felt. On Aug. 28 the volcano was again at rest, at least, only a small cloud was seen coming out of the crater.

WE take the following from the *Times of India* :—"The *Western Star*, which is *par excellence*, the journal for marvels, tells the following story of a murder :—The manner in which the murderers were detected would, our contemporary adds, if true, go far to prove the Darwinian theory. The story briefly told is this: A Madrassee had a monkey which he was very fond of. The man had occasion to go on a journey, and took with him money and jewels, and his chum the monkey. Some rogues determined to rob him of everything he had; accordingly they lay in wait for him and murdered him. Having secured the money and jewels they threw the murdered man into a dry well, and having covered it up with twigs and dry leaves, they went home. The monkey, who was on the top of a tree, saw the whole of the proceedings, and when the murderers departed he came down and made tracks for the Tahsildar's house, and by his cries and moans attracted the attention of that functionary. Inviting the Tahsildar by dumb signs to follow him, the monkey went to the well and pointed downwards. The Tahsildar thereupon got men to go down, and of course the body was discovered. The monkey then led the men to the place where the jewels and money were buried. He then took them to the bazaars, and as soon as he caught sight of one of the murderers he ran after him, bit him in the leg, and would not let him go till he was secured. In this way all the murderers were caught. The men, it is said, have confessed their crime, and they now stand committed for trial before the Tellicherry Court at the ensuing session. That monkey, we think, ought to be made an inspector of the police."

THE Panama papers report an increasing demand for the Colombian gaucho, and urge the Government to the enactment of regulations to prevent the entire destruction of the forests of these trees in Darien, where they are most abundant. Instead of simply treating the trees for the juice, as the maples are managed in the United States, the tree is cut down, and, of course, no further benefit can be derived from it. In illustration of the extent to which this vegetable product is now being collected, the *Panama Star and Herald* informs us that 160 tons had just been brought to that city as the cargo of a single vessel, mostly from the vicinity of Guayaquil.

SCIENTIFIC SERIALS

THE *Scottish Naturalist* for January.—This number is mainly occupied by a number of short papers illustrative of various subjects of interest or novelty in the natural history of Scotland, among which we may notice especially the British species of *Crambus*, a genus of moths, by the Editor; on the Cachalot or Sperm-whale (*Physeter macrocephalus*) of the north-east of Scotland, by Robt. Walker, with plate; and the commencement of the Editor's "Insecta Scotica," an essay to catalogue the insects inhabiting Scotland, with a map to show the natural divisions of the country into the 12 districts adopted in the list. The introductory remarks to the Editor's catalogue of Lepidoptera are valuable, and the article, when completed, promises to be an important contribution to British zoological literature.

THE *American Journal of Science and Art* for November 1871 opens with a continuation of Prof. Le Conte's elaborate paper on "Some Phenomena of Binocular Vision." Prof. Dana, in an article on the position and height of the elevated plateau in which the glacier of New England in the glacial era, had its origin, considers that the idea of one central glacier source for the whole continent is without foundation. The icy plateau he locates at the watershed between the St. Lawrence valley and Hudson's Bay at an altitude at least 4,500 feet above the present level. With the exception of a preliminary catalogue of the bright lines in the spectrum of the chromosphere, by Prof. C. A. Young, which we propose to reprint, the remaining papers in this number are chiefly chemical, and of varied interest, but of which it would be impossible to give the substance in the form of a brief abstract.

The first article in the December number treats of the geological history of the Gulf of Mexico, and is accompanied by a map, which is, unfortunately, not coloured, and is hence somewhat obscure. The article is divided into three portions, treating respectively of the cretaceous period, the tertiary period, and the quaternary beds. This is followed by an article by Asaph Hall, on the Astronomical Proof of a Resisting Medium in Space. It will be remembered that one of the main proofs of the existence of the interstellar æther is the retardation of Encke's Comet. So long ago as the year 1819 Encke calculated that the periodic times of the comet had diminished to the extent of more than half a day during thirty-three years. Thus the periodic time between 1786 and 1795 was 1,208·112 days, while between 1805 and 1819 it was 1,207·424; and in order to account for the diminution, Encke adopted the hypothesis of a resisting medium in space. From later observations of this and other comets, Mr. Hall is led to the conclusion that comets furnish no proof of the existence of the æther, and that the retardation of Encke's comet is due to some unknown cause, possibly to the fact of its passing through streams of meteoric matter, which may influence its motion. —Mr. Southworth gives an account of a new Micrometric Goniometer eye-piece, formed by means of a micrometer capable of measuring to the $\frac{1}{25000}$ of an inch.—Dr. Dawson contributes an article on the bearing of Devonian Botany on questions as to the Origin and Extinction of Species, in which he expresses a hope that the further study of fossil plants may enable us thus to approach to a comprehension of the laws of the creation, as distinguished from those of the continual existence of species. The other articles relate to the American Spongilla, a Craspelote, Flagellate Infusorian, by Professor H. James Clark; description of a Printing Chronograph, by the use of which it has been proved that "for three observers, twice as many observations can be reduced in the same time as when a recording chronograph is employed." The next paper was read before the American Association at Indianopolis, and discusses the longitude determination across the Continent. This embodies results obtained by the Coast Survey, in their endeavours to determine the longitude of San Francisco and various intermediate points by telegraphic exchange of clock signals with the Harvard Observatory.—The remaining papers treat of the Invertebrata dredged in Lake Superior in 1871; and of Kilauea and Mauna Loa.

In the number for January 1872, the commencement of Vol. iii. of the new series, we find a valuable article on Alpine geology by Prof. Sterry Hunt, in the form of a review of Favre's *Recherches Géologiques*. Mr. John De Laski notices the evidence of glacial action on Mount Katahdin, the highest land in Maine, and of the Devonian formation, now 5,000 feet above the sea, the top of which he believes to have been overridden by the glacier. The total thickness of the glacier he estimates at not less than 8,000 feet, and believes that by the slow grinding motion of this ice-sheet all the surface of New England became broken up to great depths. We have again a number of chemical articles and an interesting contribution to geology by Mr. C. H. Hitchcock, on the Norian or Upper Laurentian Group of New Hampshire. In this number there is also, as usual, a variety of miscellaneous information on the various branches of physical and natural science.

SOCIETIES AND ACADEMIES

London

Royal Society, January 25—"On the Action of Low Temperatures on Supersaturated Solutions of Glauber's Salt." By Charles Tomlinson, F.R.S.

"On the Elimination of Alcohol." By A. Dupré, Lecturer on Chemistry at Westminster Hospital. Communicated by W. Odling, F.R.S.—Obviously three results may follow the ingestion of alcohol. All the alcohol may be oxidised and none be eliminated, or a portion only may be oxidised and the rest be eliminated unaltered; or, lastly, all may be eliminated again unaltered. Assuming the last to be the case, it would follow that, if a certain quantity of alcohol be taken daily, the amount eliminated would increase from day to day until, at last, the amount eliminated daily would equal the daily consumption, be this time five, ten, or more days. If, on the other hand, all the alcohol consumed is either oxidised or eliminated within twenty-four hours, no increase in the daily elimination will take place in consequence of the continuance of the alcohol diet. Guided by these considerations the author undertook two series of experiments, in which the amount of alcohol eliminated by both kidneys and lungs was carefully estimated. The analytical process is employed are described in detail. First series:—After a total abstinence from alcohol for eleven days, the urine and breath were examined, after which, from the 12th to the 24th day, both inclusive, the author took 112 cub. centims. of brandy daily (equal to 48·68 grms. absolute alcohol). The urine and breath were examined on the 12th, the 18th, and the 24th day. The urine was also examined during the five days following the cessation of the alcohol diet. The analytical results obtained are given in a table. Second series:—After having again abstained from the use of alcohol in any shape during ten days, the author took 56 cub. centims. of brandy (same as above) at 10 A.M. on March the 29th. The urine was collected from three to three hours up to the 12th, from the 12th to the 24th, and during the next succeeding two days. The alcohol eliminated in the breath was also estimated during the same intervals. The analytical results are also arranged in a tabular form. The results of both series may be summed up as follows:—The amount of alcohol eliminated per day does not increase with the continuance of the alcohol diet; therefore all the alcohol consumed daily must, of necessity, be disposed of daily; and as it certainly is not eliminated within that time, it must be destroyed in the system. The elimination of alcohol following the ingestion of a dose or doses of alcohol ceases in from nine to twenty-four hours after the last dose has been taken. The amount of alcohol eliminated, in both breath and urine, is a minute fraction only of the amount of alcohol taken. In the course of these experiments, the author found that, after six weeks of total abstinence, and even in the case of a teetotaller, a substance is eliminated in the urine, and perhaps also in the breath, which, though apparently not alcohol, gives all the reactions ordinarily used for the detection of traces of alcohol, viz., it passes over with the first portions of the distillate, it yields acetic acid on oxidation, gives the emerald-green reaction with bichromate of potassium and strong sulphuric acid, yields iodoform, and its aqueous solution has a lower specific gravity and a higher vapour tension than pure water. The presence of a substance in human urine and the urine of various animals, which yields iodoform, but is not alcohol, had already been discovered by M. Lieben. The quantity present in urine is, however, so small that the precise nature of this substance has not as yet been determined. Finally, the author points out an apparent connection between this substance and alcohol. It was found that, after the elimination due to the ingestion of alcohol had ceased, the amount of this substance eliminated in a given time at first remained below the quantity normally excreted, and only gradually rose again to the normal standard. A careful study of this connection may perhaps serve to throw some light upon the physiological action of alcohol.

"The Absolute Direction and Intensity of the Earth's Magnetic Force at Bombay, and its Secular and Annual Variations." By Mr. Charles Chambers, F.R.S., Superintendent of the Colaba Observatory.—The observations discussed in this paper were taken at the Colaba Observatory during the years 1867 to 1870, and consist of observations of Dip, Declination, and Horizontal Intensity. The principal results deduced by the author from these observations are shown in the following statement:—

Magnetic Element	Epoch.	Value at epoch.	Value at common epoch, January 1st, 1869.	Secular change. — Per annum.	Semiannual inequality — Excess of April to September over mean of year	Calculated probable error of a single weekly determination.
		° ′ ″	° ′ ″	′ ″	″	″
Declination . .	April 1, 1868	0 46 47 E.	0 48 36 E.	+2 5	+1	±20
Dip	Oct. 1, 1868	19° 4′·2	19° 4′·7	+1 9	+0′·3	±0·25*
Horizontal Force .	April 1, 1869	8·0591	8·0581	+·0040	·0000	±·0043*
Total Force . .	Jan. 1, 1869	8·5264	8·5264	+·0059	+·0003	—

In column 2 is entered the mean epoch to which the mean value of each element, entered in column 3, corresponds.

The absolute observations were taken at a height of 38 feet above the ground, and by comparing them with observations taken with differential instruments at a height of 6 feet above the ground, they are shown to indicate distinctly a diminution of terrestrial magnetic action with increase of height, with respect both to secular variation of Declination and Horizontal Force, and to diurnal inequality of Horizontal Force.

Royal Geographical Society, January 22.—Sir H. C. Rawlinson, president, in the chair.—Mr. C. R. Markham, secretary, read, at the request of the president, the following statement regarding the proposed Exhibition for the Search and Relief of Dr. Livingstone:—"Letters were received from Livingstone, dated at Lake Bangweolo on July 8, 1868, and the last that have come to hand were dated Ujiji, May 30, 1869. He announced that the work still before him was to connect the lakes he had discovered; and he intended to explore a lake to the westward of Tanganyika, in the Manyema country, and thence to complete his labours, but he was sorely in need of men and supplies. The Arab traders interested in the slave-trade were anxious to thwart him, and no one would take charge of his letters. He mentioned having written thirty-four letters which had been lost. This is the last positive news from Dr. Livingstone. There was one Arab report in November 1870, that he was at the town of Manakoso, with few followers, waiting

* In English units.

for supplies, and unable to move; but the last certain intelligence will be three years old on the 30th of next May. The question now is, shall this great and noble-hearted man be left to his fate? In January 1870 the Treasury sanctioned a grant of 1,000*l.* to send stores by natives from Zanzibar through the political agent; but this method of affording relief failed, and neither letters from Livingstone nor proof that he ever received the stores have reached the coast. Mr. Stanley, an American traveller, has also attempted to penetrate into the interior, but he was stopped by disturbances at Unyanyembe. It has thus become clear that, if Livingstone is to be relieved, a properly equipped expedition, ably commanded, must be despatched from this country to do the work. The Lords of the Treasury have declined to grant any pecuniary aid to the expedition which is destined to bring succour to Dr. Livingstone, who, it must always be remembered, is Her Majesty's Consul for the interior of Africa. No adverse decision from the Treasury will, however, be allowed to check the necessary preparations, nor to retard them for a single day. The known facts upon which the Council of the Society have had to base their decision are few, but they all pointed to one obvious course. According to the latest rumours, which were to some extent corroborated by the great traveller's expressed intention, Dr. Livingstone is in the Manyema country, to the westward of Lake Tanganyika, where he may be prostrated by sickness, and where, at all events, according to his last letters, he was urgently in want of supplies. As experience has proved that it would not be safe to entrust the charge of supplies to the Arab traders, the only alternative is to despatch a relief expedition led by Europeans, and the Council of the Society had determined on that course. The fortunate accident that an excellent opportunity offered itself of reaching Zanzibar in the first steamer that has ever made the direct voyage by the Suez Canal was a sufficient reason for the rapidity with which it was necessary to prepare and despatch the expedition. Nearly 200 persons had volunteered to take part in the expedition, and the choice of a leader had fallen upon Lieut. Llewellyn Dawson, R.N., a scientific seaman, who possessed most of the qualifications which were needed to fill so difficult and trying a post, and in whose ability and judgment the Council had perfect confidence. It was intended that he should be accompanied by a second in command, and the Foreign Office had applied to the Admiralty that any naval officer who served on this expedition should be rated on one of Her Majesty's ships, so as to be allowed time and full pay. Mr. W. Oswell Livingstone, Livingstone's son, who was born twenty years ago in the neighbourhood of Lake N'gami, would also accompany the expedition. It was hoped that Mr. New, a gentleman connected with the Mombas Mission, would act as interpreter, and the party would in all consist of an escort of about fifty picked men, besides porters. It would leave England early in February in the *Abydos* steamer, chartered by Messrs. J. Wiseman and Co., who had generously undertaken to convey all stores free of charge, and, if possible, to secure reduced charges for passages for the members of the expedition." A discussion ensued on the reading of this statement, in which Mr. J. R. Andrews, Dr. Purcell, Mr. Lee, Mr. J. Ball, Admiral Collinson, Mr. Thorpe, the Rev. Horace Waller, and others joined. The letter from the Treasury declining to aid was called for and read, and comments made on the possible meaning of the chief sentence in the letter—"A new expedition is not the only means left through which Dr. Livingstone's safety may with reason be hoped for." The following communications were read:—1. "Letter to Dr. Kirk on an Ascent of Kilimanjaro." By the Rev. Charles New, of Mombasa. This letter describes the recent visit of the author to Chagga and his ascent of Mount Kilimanjaro to the snow-line. Mr. New had made a collection of plants growing in the upper zones of vegetation on the mountain which he had forwarded to Dr. Hooker at Kew. He described the varied zones, from the tropical country at the base of the mountain up to the magnificent snow-coloured dome which forms the summit. The lower slopes were covered with dense forests of gigantic trees clothed with mosses, the upper of heaths and green pastures. 2. "Ascent of the Padass River and Visit to the *Muruts* Country in Northern Borneo." By Lieut. C. de Crespigny, R.N. This journey was undertaken in the search of ourang-otangs or *Mias*, which abound in that part of Borneo. The Padass rises on the slopes of the lofty mountain Kini-balu, and flows through a plain furrowed by the courses of many other rivers. Much information was given concerning the *Paluans* and *Muruts*, and other little-known tribes, and cases of the employment of ourang-otangs as domestic servants, employed to collect fire-wood, &c., were given.

Entomological Society, January 22.—Mr. A. R. Wallace, president, in the chair.—The Rev. T. A. Marshall, and Messrs. H. W. Bates, A. Müller, and F. Smith, were elected into the council, to replace members retiring therefrom. Prof. Westwood was elected president; Mr. S. Stevens treasurer; Messrs. McLachlan and Grut, secretaries; and Mr. Janson, librarian. The retiring president read an address, and the meeting ended with the usual votes of thanks to the officers.

Victoria Institute, January 22.—Mr. Charles Brooke, F.R.S., in the chair.—Dr. W. M. Ord, "On the influence of colloid matters upon crystalline forms," illustrated by numerous diagrams and specimens. Having briefly defined the use of the terms, he proceeded to show that when crystalline substance was deposited in a colloid, such as gum or albumen, it assumed not a crystalline, but a globular form. Diagrams showing the various changes that took place illustrated this part of the lecture. The action of salt water on the carbonate of soda in the case of the shell of the lobster, and the changes in the organisms were explained; the formation of bone in hawk-man tortoise and the codfish were alluded to, and Dr. Ord concluded by drawing attention to the importance of the investigation of the chemistry of colloids.

GLASGOW

Geological Society, January 11.—Mr. John Young, vice-president, in the chair. Mr. James Thomson, F.G.S., read a paper on *Palæocoryne scoticum* and *P. radiatum* from the carboniferous shales of the West of Scotland. He stated that at the first excursion of the society to Corrieburn, in 1858, he had observed in some portions of shale a small, delicate, stellate body which he could not refer to any genus or species he had seen described. Since then, at various Saturday afternoon excursions of the society, he had discovered other forms of a similar kind. He had consulted the collections of the Geological Society, the Government Museum of Practical Geology, and the British Museum in London, without finding any similar organisms; and lacking the necessary facilities for prosecuting the work himself, he had at length placed them in the hands of Prof. Duncan, in order that they might be identified and named. On investigation Prof. Duncan found them to be new and undescribed forms which could only be referred to the *Hydrozoa.* The calcareous investments of these *Palæocorynida* made their recognition as true Hydrozoa a matter of some difficulty; but this had been overcome by the examination of the anomalous genus *Bimeria* (Wright), which, as pointed out by Prof. Duncan, shows a very decided resemblance to the fossil under consideration, the semi-solid investment being continued over the greater part of the tentacles and upper part of the body. These minute but interesting forms are found both in our highest and lowest beds of limestone—at Roughwood, Broadstone, Auchinskeigh, and Gare—and their discovery may be said to add another link to the chain that unites the present with the remote past.—Mr. Thomson also gave notes on a new species of *Palæchinus*, from the limestone shale of Auchinskeigh. It was most nearly allied to Dr. Scoular's species *sphæricus*, but differed in the form and ornamentation of both the ambulacral and interambulacral plates. He proposed to name it provisionally *Palæchinus scoticus*. Mr. Thomson exhibited the fossils and some beautiful microscopic sections in illustration of his paper.

PARIS

Academy of Sciences, January 22.—A paper by M. J. Boussinesq on the geometrical laws of the distribution of pressures in a homogenuous and ductile solid, subjected to plane deformations, was communicated by M. de Saint-Venant.—M. Faye read a note on Encke's comet and the phenomena which it presented at its last appearance.—A sixth letter from Father Secchi on the solar protuberances was read, containing a tabulated summary, with explanations of all the observations made upon the protuberances during the year 1871.—M. Trémaux forwarded a note on phenomena indicating the condition of the sidereal medium.—M. Delaunay communicated a note by MM. Prosper and Paul Henry, on the construction of very detailed celestial maps, and exhibited a map prepared by them on the principle indicated.—A note on the Meteorological Annual of the Paris Observatory for 1872, by M. E. Renon, was read; the author criticises some of the numerical results given in that volume.—M. E. Dubois presented a note on a marine gyroscope.—M. H. de Jacobi communicated his researches on the induction currents produced in the coils of an electro-magnet between the poles of which a metallic disc is set in motion; this paper contains results of great value.—A note by M. E. Liais on the spectrum analysis of the zodiacal light and on the corona of eclipses was read. The author states that he has found that the spectrum of the zodiacal light is continuous, and calls attention to his previous observations on the solar corona, the nature of which he claims to have established in 1858.—MM. Becquerel presented a note on the temperature of soil observed at the Jardin des Plantes, at the Observatory, and at Montsouris during December 1871 at 10 centimetres below the surface.—M. I. Pierre read a note on the simultaneous distillation of water and iodide of butyle, in which he stated that iodide of butyle boils under water at 204·8° F., rising through the water in drops with a bubble of vapour attached to each, and that during this ebullition the two liquids pass over in the proportion of 21 water to 79 iodide. Iodide of ethyle behaves similarly.—M. H. Sainte-Claire Deville presented a report on a memoir by M. Grüner on the action of oxide of carbon upon iron and its oxides.—A note by M. A. Rosenstichl, on a method of separating the two isomeric toluidines, was read. —M. P. Thenard presented a note by M. A. Houzeau on the preparation of ozone in a concentrated state.—The discussion on the subject of heterogenesis, commenced at the last meeting, was continued in two notes by MM. Balard and Fremy, and in a paper by M. Pasteur on the nature and origin of ferments.—M. J. de Seynes also presented a note in reply to a passage in M. Trécul's memoir.—M. Monnier read a paper on the functions of the respiratory organs in aquatic larvæ.—M. C. Bernard presented a memoir by MM. A. Estor and C. Saint-Pierre on the analysis of the gases of the blood; and M. Brongniart communicated a note by M. de Saporta on the fossil plants of the Jurassic epoch.

VIENNA

I. R. Geological Institution, January 16.—M. von Hauer presented the third number of the "Memoirs of the Geological Institution," containing a monograph of the Echinoderms of the more recent tertiary deposits of the Austro-Hungarian empire, by Dr. G. Laube.—M. G. Tschermak explained the contents of a memoir sent by Dr. C. W. C. Fuchs, from Heidelberg, for the "Mineralogische Mittheilungen." The author details the chemical processes which take place in lavas at the moment of the eruption, and by the observation of broken crystals in the lava, concludes that the melted masses, some time before the eruption, must have had a higher temperature than in the moment of eruption.—M. Th. Fuchs demonstrated some detailed sections of the upper tertiary strata in the neighbourhood of Vienna. They seem to prove that the marine sands appear in some localities below, in others above, the Leitha limestone.—M. Ch. Paul, on the upper tertiary strata of Sclavonia. They are divided into three different members, corresponding to the three great divisions of the strata of the Vienna basin. The lowest division, the marine beds, consists chiefly of calcareous strata, the Leithakalk. The middle division, the sarmatic beds, is formed of a large mass of sandstones which are overlain by white sands of fresh water origin. The congerian beds, finally, are separated into two members—the lower containing large layers of lignite, and characterised by *Unio maximus*, *Paludina Sadleri*, and other species of this genus with smooth shells; and the upper, without lignites and containing an entirely different fauna, also with many species of *Paludina* with ribbed and ornamented shells.—Fr. von Hauer, on new geological discoveries in Eastern Transylvania, made by F. Herbich. Between Barsyek, on the Moldavian frontier, and the region south of Kronstadt, a large range of mountains consisting chiefly of calcareous strata is developed, which had formerly been regarded as belonging almost entirely to the Jurassic formation. The recent investigations of Mr. Herbich, on the contrary, show that here are developed almost all the particular types of Alpine formations of mesozoic ages. The Trias is represented by the Wurfenslater and Guttenstein limestone, which are overlain by red Hallstatt marbles, with *Ammonites Metternichii*, &c.; the Lias by the Grosten and Adneth strata; &c. It is very remarkable that some of these strata—for instance, the Hallstatt marbles—are entirely wanting in the whole range of the Northern Carpathians, which connect the Transylvanian mountains with the Eastern Alps.

BOOKS RECEIVED

ENGLISH.—Zanzibar; City, Island, and Coast: Capt. R. F. Burton. 2 vols. (Tinsley Brothers).—Queen Charlotte Islands: F. Poole, edited by J. Lyndon (Hurst and Blackett).—Chemical Notes for the Lecture Room, 3rd edition: Thos. Wood (Longmans).—The Differential Calculus: F. Wilson (Longmans).—The Pipits: by the Author of Caw-Caw (Glasgow, J. Maclehose).

FOREIGN.—(Through Williams and Norgate.)—Die Krankheiten des Linsensystems: Dr. Max Salomon.—Lehrbuch der anorganischen Chemie, 2te Abtheilung: Dr. Ph. Th. Büchner.—Jahresbericht über die Fortschritte der Chemie für 1869, Heft 2: Ad. Stricker.—Zoologische Mittheilungen, Band 1: Dr. L. W. Schaufuss.—Thesaurus Ornithologiæ, Band 1: Dr. C. G. Giebel.—Botanische Untersuchungen, 1: Dr. N. J. C. Müller.—Geschichte der Himmelskunde: Dr. J. H. von Mädler.—Thesaurus Literaturæ Botanicæ, Fas. 1: G. A. Pritzel.—Die Foraminiferen des schweiz. Jura: Dr. J. Kübler.

DIARY

THURSDAY, FEBRUARY 1.

ROYAL SOCIETY, at 8.30.—On the Lunar Variations of Magnetic Declination at Bombay: C. Chambers, F.R.S.—On a Possible Ultra-Solar Spectroscopic Phenomenon: Prof. Piazzi Smyth, F.R.S.—On the Normal Paraffins: C. Schorlemmer, F.R.S.

SOCIETY OF ANTIQUARIES, 8.30.—On a Camp opposite Clifton on Leigh Down, with Remarks on Vitrified Forts: Rev. H. M. Scarth.

CHEMICAL SOCIETY, at 8.—On the Relation between the Atomic Theory and the Condensed Symbolic Expressions of Facts and Changes (Dissected Formulæ): Dr. C. R. A. Wright.

LINNEAN SOCIETY, at 8.—On the Classification and Geographical Distributions of Compositæ: The President.

FRIDAY, FEBRUARY 2.

GEOLOGISTS' ASSOCIATION, at 7.—Special General Meeting.—On the Chloritic Marl Deposits of Cambridge: Rev. T. G. Bonney, F.G.S.

ARCHÆOLOGICAL INSTITUTE, at 8.

ROYAL INSTITUTION at 9.—On the Identity of Light and Radiant Heat: Prof. Tyndall, F.R.S.

SATURDAY, FEBRUARY 3.

ROYAL INSTITUTION, at 3.—On the Theatre in Shakespeare's Time: Wm. B. Donne.

MONDAY, FEBRUARY 5.

ROYAL INSTITUTION, at 2.—General Monthly Meeting.

ENTOMOLOGICAL SOCIETY, at 7.

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

ANTHROPOLOGICAL INSTITUTE, at 8.—Anniversary Meeting.—On Hereditary Transmission: Geo. Harris.—Strictures on Darwinism: H. H. Howorth.—The Wallons: Dr. Charnock and Dr. Carter Blake.

TUESDAY, FEBRUARY 6.

ROYAL INSTITUTION, at 3.—On the Circulatory and Nervous Systems: Dr. W. Rutherford, F.R.S.E.

ZOOLOGICAL SOCIETY, at 9.—Contributions to a General History of the Spongiadæ, Part I: Dr. Bowerbank.—Notes on *Rhinoceros sumatrensis*, with a photograph from life: Dr. John Anderson.

SOCIETY OF BIBLICAL ARCHÆOLOGY, at 8.30.—On an Inscription in Hebrew or Ancient Phœnician Characters, discovered at Siloam, of the Age of the Kings of Juda: Ch. Clermont Ganneau.

WEDNESDAY, FEBRUARY 7.

GEOLOGICAL SOCIETY, at 8.—On the Geology of the Neighbourhood of Malaga: M. D. M. d'Orueta.—On the River-Courses of England and Wales: Prof. A. C. Ramsay, F.R.S.—Migrations of the Graptolites: Dr. H. Alleyne Nicholson, F.R.S.E.

SOCIETY OF ARTS, at 8.—On the Forests of England, their Restoration, and Scientific Management: T. W. Webber.

MICROSCOPICAL SOCIETY, at 8.—Anniversary Meeting.

PHARMACEUTICAL SOCIETY, at 8.

THURSDAY, FEBRUARY 8.

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

ROYAL SOCIETY, at 8.30.

MATHEMATICAL SOCIETY, at 8.—On the Factors of the Differences of Powers, with especial reference to a theorem of Fermat's: Mr. W. Barrett Davis.—On an Algebraical Form and the Geometry of its dual connection with a polygon, plane, or spherical: Mr. T. Cotterill.

SOCIETY OF ANTIQUARIES, at 8.30.

CONTENTS

ERRATA.—P. 243, col. 2, line 6 from top, prefix "vertical" to "band;" line 10, for "table" read "tall."