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THURSDAY, APRIL 14, 1870

THE TOTAL SOLAR ECLIPSE OF DECEMBER NEXT

ON Friday last, Mr. Lassell, the president, brought before the Royal Astronomical Society the subject of the total solar eclipse of December next, with a view to eliciting information as to the steps necessary for observing it. A most interesting discussion ensued, in which the Astronomer Royal, the president, Messrs. De la Rue, Stone, and Huggins, Admiral Ommaney, Colonel Strange, and Lieutenant Browne, R.A., took part. The line of totality passes near the following places :—Odemira, in Portugal, Cadiz, Estepona (about twenty miles north of Gibraltar), Oran, on the Algerine coast, Syracuse, and the region including Mount Etna in Sicily.

The duration of totality will be a little over two minutes of time. It is proposed that an endeavour shall be made to equip two expeditions to observe the phenomena of the eclipse at two of these points, in order that, should adverse weather occur at one station, results may be, perhaps, obtained at the other. It is thought probable that the station of Oran, in Algeria, will be occupied by a French party of astronomers. The choice for English observers seems to be between Cadiz, Gibraltar, and Syracuse. Both Admiral Ommaney and Lieut. Browne, R.A., spoke from personal experience favourably of the climate of Gibraltar at that time of the year. The speakers were unanimous in considering that both parties ought to be equipped for the following main objects:—(1) Photography; (2) Spectrometry; (3) Polarisation. Other objects of subsidiary importance, as Photometry and Meteorology, would also receive due attention. An approximate estimate of personal and instrumental force gives from 20 to 25 skilled observers, and about 10 telescopes of from 4 to 6 inches aperture, as the complement necessary for *each* of the two expeditions.

The first step which the Council propose to take is to invite, by circular and other means, those prepared to volunteer for this service to send in their names at once, specifying the particular class of observation which the observer desires to be engaged in. The number of actually available telescopes and instruments will also be ascertained.

When this preliminary information has been acquired, the Council of the Royal Astronomical Society, which has resolved itself into a committee for the purpose, will then consider whether they should apply to Government for such assistance as may enable them to utilise, with the utmost advantage, their own resources. Pending the collection of this information, it would be premature to attempt any estimate of the public assistance which may be required to guarantee the success of this enterprise. But it is not too early to lay before our readers some idea of its character and importance.

The systematic examination of the solar surface is emphatically a modern study, which has, even during the last twelve months, advanced with enormous strides. Until recently these researches were limited to the ocular inspection and photographic representation of features rendered visible at ordinary times by our improved telescopic power, and to similar modes of examining certain other features developed during eclipses. Subsequently, with the wonderful aid afforded by the spectroscope, a new class of phenomena was brought under examination, but only momentarily, on the rare occasions of total solar eclipses. Only last year M. Janssen and Mr. Lockyer, labouring independently, showed that many of the spectroscopic observations, for securing which an eclipse had been believed to be indispensable, could be made without the aid of that phenomenon,—a discovery second, in dignity and value, to none that this age has achieved. But these very methods have opened out inquiries and doubts which again require for their solution the peculiar circumstances attending total obscuration of the sun's disc.

For instance, the corona which has been seen at times to extend to a distance beyond the sun greater even than the sun's diameter, has been very generally stated to indicate a solar atmosphere, a conclusion not entirely borne out, however, by the spectroscopic method of investigation; and Dr. Frankland and Mr. Lockyer have stated their opinion that the *whole* of the corona can hardly be solar—this opinion being based partly on their approximate determination of the pressure in these regions. This question was manfully attacked during the eclipse observed last year in America, but the results, which will be found most carefully detailed in the report printed by the American Government, were not conclusive.

Again, it has been shown that the solar chromosphere is not entirely seen by the new method of observation; away from the sun its light is ordinarily so feeble that it cannot be detected through our brighter atmosphere, but during eclipses it is seen; and in this matter the American astronomers did admirable work, which, however, requires strengthening, for many still hold that the radiance depicted on the photographic plates immediately round the moon in the photographs, is not the chromosphere, as stated by Dr. Gould and others, although there are very many arguments which can be brought forward in favour of their idea that it is that envelope. Other points might easily be brought forward to show the extreme and, in fact, special importance of eclipse observations at the present time.

If researches such as these yielded no fruits beyond the satisfaction of our craving desire to know more of the structure and constitution of the sun, they would still be prosecuted with ardour. But the knowledge they are calculated to advance has a much wider range and a more tangible character than the gratification of philosophical curiosity. Sabine, Lamont, and Wolf many years ago detected the contemporaneity of magnetic disturbances and the maximum outbreak of spots on the sun's surface. More recently De la Rue, Stewart, and Loewy have established a relation between the sun spot maxima and the configuration of the planets Venus and Jupiter. Systematic observations have been carried on at the Kew Observatory continuously for nine years for the express purpose of throwing light on the apparent connection of the sun spots with magnetic and planetary phenomena. During this period upwards of nine thousand photographic pictures of the solar disc have been taken. These researches, and those of Carrington, extending over many years, have shown that though the spots, if observed from day to day and month to month, appear to break out capriciously both in point of size and position, yet when observed perseveringly for a series of years, a recurrence of phenomena, so far at least as the total area covered by spots is concerned, becomes evident. The period required to complete this cycle is variously estimated, a little over eleven years being that most generally accepted. On Thursday last, a remarkable paper by Prof. Piazzi Smyth, Director of the Royal Observatory, Edinburgh, was read at the Royal Society, in which the results given by thermometers, buried at different depths in the earth and observed for upwards of thirty years, were tabulated and discussed. The main deduction from these observations was that the temperature of the earth, divested of the effects of transient atmospheric changes, seemed subject to a secular law. This secular variation in the earth's temperature may of course be due to secular changes going on deep in the structure of the globe itself; but it may be ascribed also, and with a far higher degree of probability, to changes in the heat-supplying power of the sun.

There is one extremely important fact connected with these changes, namely, that one of them is accomplished in $11\frac{1}{10}$ years; that is, exactly in the sun spot periods as determined by Wolf, and identical, or nearly so, with the period obtained from the Kew observations.

But the spots are only one of the known evidences of changeful activity going on in the great central luminary. The form, disposition, and dimensions of the prominences, and the distribution of the chromosphere, are visibly undergoing constant alteration. May these phenomena not also have their period of recurrence? And may not they, equally with the spot outbreaks, stand in some relation to what formerly used to be considered purely terrestrial phenomena, namely, magnetism, electricity, humidity, temperature, and rainfall? To carry the hypothesis one step further: if there is a physical relation between the solar changes and meteorological occurrences, and if the solar changes are subject to laws which cause them to recur in regular series, have we not in this secular arrangement a clue by means of which climatic variations may be studied with greatly increased effect? Is not, in short, the systematic study of solar phenomena extremely important from a meteorological point of view?

If this hypothesis, which is one daily gaining strength, be but probably sound, the careful observation of the physical phenomena of solar eclipses becomes an urgent necessity, as calculated not only to afford more just and more noble views of the constitution of the universe, but to confer on mankind the same power with respect to climatal vicissitudes, which we already possess with respect to astronomical phenomena, the power of confident prediction, which will never be ours until we have a firm grasp of the secular laws by which those vicissitudes are governed.

If these views be generally accepted, as we know they will be by those acquainted with the subject, we need not fear that anything which the knowledge and devotion of our astronomical physicists, or the power of the Government, can supply, will be wanting to effect the due observation of the Solar Eclipse of December in a manner creditable to our age and our country.

A.

ON THE BASIS OF CHEMICAL NOTATION

CHEMISTS are so much in the habit of employing what are called chemical symbols, that they are liable occasionally to forget the realities symbolised; while persons interested in the realities of chemistry, but not themselves chemists, are apt to call in question the propriety of employing any such symbols at all,—looking upon the entire system of chemical expression as an arbitrary one, having its chief warrant from authority, and not only throwing an unwarrantable gloss upon the facts, but frequently overshadowing them. That the accepted system of chemical notation is, indeed, to some extent arbitrary, and that it does throw more or less gloss upon the facts, may be admitted at once as indisputable; but nevertheless its relation to the facts is so simple and direct, and its utility as a means of illustrating and classifying the facts is so remarkable, that its justification ought not to prove a seriously difficult labour.

It being the especial business of chemists to consider every material object in relation to the kind of matter of which it is composed, they have gradually become acquainted with about sixty different kinds of matter that are unalterable in their kind by way of subtraction. The entire matter of a piece of iron, for instance, may cease to exist as iron, and, by an accretion of other matter, appear in the form of rust. But, though alterable in this way by the addition of other matter than iron to it, it is experimentally unalterable by the subtraction of other matter than iron from it. Now the sixty or more different kinds of matter having this property of unalterability by subtraction, though never declared to be in their essence elementary, are always tacitly assumed to be so; and chemical changes are accordingly interpreted in a definite way which, on this particular assumption, would appear to be the only legitimately possible way, but which, irrespective of this particular assumption, can only be regarded as one of several more or less probable ways.

Making the assumption, however, with eyes shut or open, as the case may be, chemists are able to learn, by analysis, the respective weights of the different elementary substances constituting a given weight of any compound substance. The results of the analyses are, of course, expressible in various modes; the most obvious, and, so to speak, impersonal mode, being the centesimal one—the setting forth of so many parts by weights of the respective constituents in 100 parts by weight of the particular compound. But in the case of several different compounds having one or more common constituent, the relationship of composition subsisting between the different compounds is much better brought out by taking some common constituent as a constant, and the other constituents as variable in relation thereto, rather than by taking all the constituents alike as variable.

Now, among the sixty or so elements, hydrogen is characterised by this peculiarity, that in nearly all the compounds of which it is a constituent, it exists in a smaller proportion by weight than any other constituent, while in absolutely all its compounds it exists in a smaller proportion by weight than some other constituent; so that in the compounds which it forms with but one other kind of elementary matter, its proportion by weight is always less than that of the other elementary matter with which it is combined. Even in that particular hydrogen compound, namely, marsh-gas, in which the amount of constituent hydrogen is largest, its proportion reaches only to 25 per cent., while among the many thousands of hydrogen compounds known to chemists, the following, and certain of their immediate congeners and isomers, are almost the only ones containing hydrogen to the extent of 11 per cent. and upwards :—

	Per-centage of constituent hydrogen.
Marsh-gas	25·0
Higher paraffins	14 to 20·0
Ammonia	17·6
Methylamine	16·1
Higher alcohol bases	14 to 15·5
Olefiant gas and homologues	14·3
Higher alcohols	13 to 14·0
Wood-spirit	12·5
Water	11·1

From the circumstances, then, of hydrogen forming so small a proportion by weight of the compounds it helps to constitute, its proportion may conveniently be taken as unity, and the composition by weight of the above tabulated hydrogen compounds be preferably expressed as follows :—

	Parts by weight.		
Marsh-gas	1	hydrogen to	3·0 carbon
Ethyl hydride	1	,,	4·0 carbon
Ammonia	1	,,	4·7 nitrogen
Methylamine	1	,,	5·2 nitrogen + carbon
Ethylamine	1	,,	5·4 nitrogen + carbon
Olefiant gas	1	,,	6·0 carbon
Alcohol	1	,,	6·6 oxygen + carbon
Wood-spirit	1	,,	7·0 oxygen + carbon
Water	1	,,	8·0 oxygen

Now, while hydrogen is thus the least weighty, it is usually also the most mobile constituent of its several compounds. Accordingly, by acting on its several compounds with various reagents, it is possible to effect a removal of more or less hydrogen from them, often in the form of free hydrogen gas, more often in the form of some familiar hydrogen compound, such as water or muriatic acid. For instance, if muriatic acid itself, formic acid, ortho-phosphoric acid, and acetic acid, be each of them acted upon with either metallic sodium or caustic soda, taking care to keep the acid in excess, new compounds are produced, the composition of which in relation to that of the original acids may be expressed as follows :—

Muriatic acid and sodium chloride.

1 hydrogen + 35·5 chlorine
23 sodium + 0 hydrogen + 35·5 chlorine

Formic acid and sodium formiate.

1 hydrogen + 6 carbon + 16 oxygen
11·5 sodium + $\frac{1}{2}$ hydrogen + 6 carbon + 16 oxygen

Phosphoric acid and sodium phosphate.

1 hydrogen + 10·3 phosphorus + 21·3 oxygen
7·6 sodium + $\frac{2}{3}$ hydrogen + 10·3 phosphorus + 21·3 oxygen

Acetic acid and sodium acetate.

1 hydrogen + 6 carbon + 8 oxygen
5·7 sodium + $\frac{3}{4}$ hydrogen + 6 carbon + 8 oxygen

It is observable that the new compounds differ in composition from the original acids by a consecutively decreasing gain of sodium, and by a corresponding loss of the whole, of one-half, of one-third, and of one-fourth the original hydrogen respectively; and there is this additional point for consideration, that while in the case of formic acid and acetic acid it is not possible to obtain a compound differing from the original acid by a removal of one-third of its hydrogen, in the case of phosphoric acid it is not possible to obtain a compound differing from the original acid by a removal of one-half or one-fourth of its hydrogen. But, by further treatment of phosphoric acid with caustic soda, another compound may be obtained, differing in composition from the original acid by a removal of two-thirds, instead of one-third, the original hydrogen; while, by treatment of acetic acid with chlorine, a series of new compounds may be obtained, differing in composition from the original acid by a removal of one-fourth, and two-fourths, and three-fourths successively of the original hydrogen. Anyhow, the tendency of the hydrogen of formic acid is manifestly to break into halves, that of the hydrogen of phosphoric acid to break into thirds, and that of the hydrogen of acetic acid to break into quarters.

Now, assuming the reacting units of the four acids to contain each but a single proportion, or one part by weight of hydrogen, there seems no reason why this hydrogen should in each case break up in a specifically different manner; and, in other cases, in yet different manners, as into sixths, eighths, twelfths, and so on. But assuming the re-acting unit of formic acid to contain two proportions, that of phosphoric acid to contain three proportions, and that of acetic acid to contain four proportions of hydrogen, the reason of the different mode of breaking up becomes perfectly obvious, as shown in the following comparison with respect to composition of the original acids and their produced sodium salts; whereby it appears that a similar exchange of twenty-three parts by weight of sodium for one part by weight of hydrogen is effected in each of the four reactions.

Muriatic acid and sodium chloride.

1 hydrogen + 35·5 chlorine
23 sodium + 0 hydrogen + 35·5 chlorine

Formic acid and sodium formiate.

2 hydrogen + 12 carbon + 32 oxygen
23 sodium + 1 hydrogen + 12 carbon + 32 oxygen

Phosphoric acid and sodium phosphates.

3 hydrogen + 31 phosphorus + 64 oxygen
23 sodium + 2 hydrogen + 31 phosphorus + 64 oxygen
46 sodium + 1 hydrogen + 31 phosphorus + 64 oxygen

Acetic acid and sodium acetate.

4 hydrogen + 24 carbon + 32 oxygen
23 sodium + 3 hydrogen + 24 carbon + 32 oxygen

This, then, is the assumption actually made by chemists, and further warranted by many important considerations. For example, ammonia has the property of forming compounds with the above acids by direct combination or addition; and the respective maximum quantities of the formic, phosphoric, and acetic acids, with which a given weight of ammonia can so combine, do actually yield twice, three times, and four times respectively the particular weight of hydrogen that is yielded by the maximum quantity of muriatic acid with which that same weight of ammonia can combine. Instead, therefore, of regarding the unit weights of all hydrogen compounds as including alike a single proportion of hydrogen, chemists regard them as including 1, 2, 3, 4, ... and x proportions of hydrogen respectively, accordingly as their constituent hydrogen is capable of removal in the ratios $\frac{H}{-}, \frac{H}{2}, \frac{H}{3}, \frac{H}{4}, \ldots$ and $\frac{H}{x}$, respectively. And this position, as to the relative unit weights of different chemical substances, arrived at by the above or by some other method of attack, is the gist of the whole question. Admitted, the rest follows as a matter of course: and it will hardly be arguing in a circle to adduce the simplicity of what follows as a reason for admitting the position on which it is consequent.

The relative unit weights of different hydrogen compounds being determinable in this way, certain relations of quantity subsisting among other common constituents of the different compounds become very quickly apparent, as shown in the following examples:—

Caustic potash.
1 hydrogen + 39 potassium + 16 oxygen

Formic acid.
2 hydrogen + 12 carbon + 32 oxygen

Nitric acid.
1 hydrogen + 14 nitrogen + 48 oxygen

Phosphoric acid.
3 hydrogen + 31 phosphorus + 64 oxygen

It is obvious that in the units of these different compounds, determined with respect to their constituent hydrogen, their constituent oxygen amounts to one, two, three, and four times sixteen parts by weight respectively; and it further appears that, whenever the units of different compounds differ from one another by their amounts of constituent oxygen, the increment or decrement of oxygen is always sixteen parts or some multiple of sixteen parts, as exemplified in the case of mono-potassic succinate, malate, and tartrate, for instance—

Potassium	39 +	hydrogen	5 +	carbon	48 +	oxygen	64
,,	39 +	,,	5 +	,,	48 +	,,	80
,,	39 +	,,	5 +	,,	48 +	,,	96

Thus, from an examination of the above, and of thousands of other instances, it would appear that the proportion by weight of constituent oxygen present in the reacting unit of any chemical substance is invariably sixteen parts, or some multiple of sixteen parts; that when two or more units of chemical substance differ from one another by the weight of their constituent oxygen, the difference always amounts to sixteen parts, or some multiple of sixteen parts; and, in fact, that sixteen parts by weight of oxygen constitute the smallest proportion by weight of oxygen, relatively to one part by weight of hydrogen, that can be introduced into, or educed from, any unit of chemical substance.

Similarly it may be shown that twelve parts by weight of carbon constitute the smallest combining proportion of carbon, relatively to one part by weight of hydrogen, and to sixteen parts by weight of oxygen; and so, not only to carbon and to oxygen, but to every presumed elementary body, there may be assigned a particular number, termed its proportional number, expressing the smallest proportion by weight of the particular body, relatively to one part by weight of hydrogen, that is found to exist in any unit of chemical substance. These relative quantities of the different elements, namely, one part by weight of hydrogen, sixteen parts by weight of oxygen, twelve parts by weight of carbon, fourteen parts by weight of nitrogen, twenty-three parts by weight of sodium (natrium), thirty-nine parts by weight of potassium (kalium), &c., &c., are denoted by the initial letter or letters of the names of the respective elements; so that the following composite expressions for the previously adduced potassium salts,

Succinate	$KH_5C_4O_4$
Malate	$KH_5C_4O_5$
Tartrate	$KH_5C_4O_6$

indicate the unit weights of the several salts to consist of once thirty-nine parts by weight of potassium, of five times one part by weight of hydrogen, of four times twelve parts by weight of carbon, and of four, five, and six times sixteen parts by weight of oxygen respectively.

To say that the relative proportions by weight of the different elements, expressed as above by the initial letters of their respective names, constitute the smallest proportions of them that are existent in and transferable to or from any unit of chemical substance, is tantamount to saying that they constitute indivisible or atomic proportions. Accordingly, the relative weights of these proportions are very commonly spoken of as atomic weights, and the proportions themselves as atomic proportions. Some most distinguished chemists maintain, indeed, that these atomic weights are really the relative weights of distinct physical particles, or atoms. Other chemists, while not denying that this may be so, do not admit that it necessarily must be so, and, when using the word "atom" at all, employ it simply as a convenient synonyme or abbreviation of the phrase "atomic combining proportion."

It is further noteworthy, that the above deduced elementary atomic weights, or smallest relative weights of different elementary matter that are found to exist in a unit of chemical substance, also constitute the relative weights of different elementary matter which are specially comparable with one another in regard to space, to diffusive movement, to heat, and to single and multiple powers of colligation and mutual replacement.

WILLIAM ODLING

THE VOYAGE OF THE NOVARA

Reise der Osterreichischen Frigatte "Novara" um die Erde, in den Jahren 1857-58-59, *unter den Befehlen des Commodore B. von Wüllerstorf-Urbair.* Anthropologische Theil. Bearbeitet von Dr. Fried. Müller. (Vienna. 1868.)

THIS important work scarcely appears to have attracted the attention it deserves, and we propose referring to a few of the more interesting facts it contains.

The object of ethnography, Dr. Müller observes, is not to regard man as an individual, but as a member of a family, and hence to consider him by such light as can be gained from the investigation of his speech, his thoughts, his feelings, and his entire mode of living. He thinks the classification of the different races of man in accordance with the colour of the skin and the characters of the hair, extremely unsatisfactory, though adopted by many of the best anthropologists of modern times, as Linnæus, Blumenbach, Cuvier, Pickering, &c., nor less so the method of Retzius, who attended exclusively to the form of the skull and face. Race and language, or form of speech, on the other hand, he thinks, are associated by the closest and profoundest ties. The persistence of some of the races whose contours have been handed down to us by the artists of the ancient Egyptians and Persians may, he considers, at a low estimate, be placed at 8,000 years, since it is likely that they had endured at least as long previously to their being fixed in stone as they have done since. Everything, he thinks, serves to show the persistence and invariability of race. But if we pass from man regarded from an anthropological to an ethnographical point of view, his unchangeability is no longer perceptible. The form of the land, the climate, the Flora and Fauna by which he is surrounded, all exert a powerful influence upon him. The low grade of mental development on which the Australian stands, may easily be attributed to the singular dearth of useful plants and useful animals by which he is surrounded; and the Polynesian would undoubtedly have advanced to a higher level, if the plants and animals around him had been appropriate objects to stimulate and extend his intellectual faculties. The views here expressed, it will be seen, are curiously in accordance with those expressed by Buckle.

Dr. Müller estimates the total number of inhabitants on the earth at 1,342 millions, an estimate which differs from that of Behm by only five millions. He divides them into the following races:—1. Australian; 2. Japanese; 3. Malays; 4. Ballaks; 5. African Negroes; 6. Central Africans; 7. Hottentots; 8. Caffres; 9. Americans; 10. Northern Asiatics; 11. South Asiatics; 12. High Asiatics; 13. Europeans.

A general view of the ethnology and language of each of these is given, with details of those subdivisions that were encountered by the *Novara* in her voyage. Some of these are excellently drawn up, and contain much original and interesting matter. To take one as a specimen—the Chinese.

These he regards as representing the highest type to which the Mongolian type can attain, and standing to the yellow races in the position that the Greeks of old did, and the Germans, French, and English of the present day, do to the nations of Europe.

The physical features of the country and the characters of the climate are lightly sketched. Their Fauna and Flora are stated to be richer in useful animals and plants than any other region of the earth. Their clothing, dwelling, food, amusements, and arms are then described. The character of the modern Chinese is hit off in a few happy touches. The basis of his character is rest. Hence his condition of stagnation. His knowledge leads always to the same results; the present is still the best, and for the ideal, and the improvement and advance of the future, be it never so golden, he has no aspirations. The ceremonies of marriage and the occupations of daily life are detailed. The children are stated to be well educated, and it is noticeable that in the better families even the girls are taught general literature, music, and painting. Their trade, religion, and, finally, their language, are considered. The same plan is pursued with the other divisions, and the reader is presented with a very entertaining, though highly condensed, account of the principal types of mankind.

OUR BOOK SHELF

Alpine Flowers for English Gardens. By W. Robinson, F.L.S. (London: J. Murray. 1870.)

THE author of "The Parks, Promenades, and Gardens of Paris," presents us here with a work which will be of great value to every lover of gardening. Although the formal and unsightly monstrosities of Loudon's "Landscape and Suburban Gardener" are now happily out of date, there is probably no department of landscape gardening in which a cruder and more artificial taste is still displayed than in the construction of rock-work. Not only is the prevalent style of rockery faulty from an æsthetic point of view, but, as Mr. Robinson shows, it is eminently unfitted for the growth of Alpine plants, which, even when their stems reach only a few inches above the ground, strike their roots feet, and even yards, into the soil with which the crevices in the rock are filled, in order to enable them to withstand the sudden droughts to which they are subject. Messrs. Backhouse, of York, have shown how, by careful attention to the conditions under which plants thrive in their native habitats, many ferns and flowering plants which are usually seen only in greenhouses, can be successfully grown on out-of-door rockeries; and if the directions given by Mr. Robinson are carefully followed, any professional gardener or private gentleman, with the appliances ordinarily found in a moderately-sized garden, will be able to produce results which will astonish his friends and neighbours. The descriptive list of Alpine flowers, with the soil and treatment suited to each, is complete and valuable; some of the illustrations are pretty, others are on too small a scale to be effective.

Systematisches Verzeichniss der in Deutschland lebenden Binnen-Mollusken, zusammengestellt, von Carl Kreglinger. 8vo. (Wiesbaden, 1870.)

A BOOK of 403 pages, and merely a list of the inland (or land and freshwater) Mollusca of Germany, without any description or figure. Nearly one-half of this extensive compilation is taken up with useless synonyms of the species. Among the chaff there is some good grain in the nature of geographical and geological distribution. The author does not seem to be a species-maker; although in some cases he attaches, in my opinion, too much importance to slight and local differences. However, there is unfortunately no court of appeal. He evidently has not consulted all the works which he cites; or he would not have adopted Dr. J. E. Gray's specific name of *striatula* for the *Zonites radiatulus* of Alder, the former having described or rather indicated the species as "*Helix Zonites striatula*," and thus contravened the established rules of nomenclature. Nor do we find any reference to works which were published last year before the date of his preface, for instance, the concluding volume of "British Conchology." Herr Kreglinger enumerates 347 species as inhabiting Germany—a wide range, extending from Schleswig-Holstein to Dalmatia (a distance of between 800 and 900 miles), and comprising every variety of situation and soil, mountain, forest, pasture, woodland, lake, river, marsh, and the sea-coast. Indeed, in the last respect, he has "travelled out of the record" by adding some unquestionably marine species belonging to the genera *Melampus* and *Truncatella*. The number of British inland species is 125. Of *Clausilia* we have 4 only, while Germany boasts of 54; of *Vitrina* and its allies we possess but 1 out of 9, of *Neritina* 1 out of 5, and of *Hydrobia* (or *Paludinella*) 1 out of 18; the genera *Zospeum* and *Lithoglyphus*, which are peculiar to South Germany, and the family of *Melania* are utter strangers to our country. It is to be regretted that the author has without inquiry followed L. Pfeiffer in recognising such genera as *Azeca* and *Ferussacia*. Those few workers, to whom the high price of 20*s*. may not be an object, will be glad to have this *catalogue raisonnée* in their libraries.

J. GWYN JEFFREYS

LETTERS TO THE EDITOR

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

The Dinornis

I OBSERVE in your interesting paper of Feb. 17th, a statement that the larger varieties of Dinornis had, in all probability, become extinct before the occupation of the Middle Island of New Zealand by the present race of natives. I have observed previous statements to the same effect, supported by the authority of gentlemen whose opinions deserve the highest consideration, and by the assertion that no tradition of the existence of such birds has been found amongst the present representatives of the native race. I have good reason to question the accuracy of the latter assertion, at any rate.

I was myself in New Zealand for nearly seven years, from 1841 to 1848, and I had unusual opportunities of becoming acquainted with the condition of the Middle Island as it then was, having been in the service of the New Zealand Company as a surveyor and explorer in the settlement of Nelson, and subsequently in the other districts now known as Canterbury, Otakou, and Southland. I can state positively that some of the natives then resident in the Motueka and Motupippi districts of the Nelson settlement, at a time when the actual existence of such birds past or present had not been suspected, told us what appeared to us to be foolish stories about large birds which their immediate ancestors had been in the habit of hunting. One of them described to us most vividly the manner in which they beset these birds with dogs, and the mode in which the birds defended themselves by kicking. He stated that the dogs were frequently killed by a single kick, and that men not unfrequently had limbs broken in the same way. Other stories there were of an extravagant character, indicating perhaps a more remote origin—about birds so very large that one of them was said to have pulled down out of a tall tree an unfortunate hunter who had endeavoured to conceal himself there, and had *eaten* him on the spot; and these latter stories, no doubt, induced us to treat the others with less consideration.

I never met a native chief who told me that he had himself seen such a bird alive, and I do not think that any native whom I should have been inclined to trust ever told me even that his *father* had seen such birds, but they did assert expressly that their fathers—by which they would mean immediate ancestors, had so hunted and killed these large birds. I was further assured, at a later period, by a native chief named Teraki, who resided near the mouth of the Taieri River in the Otakou district, that he believed such birds still existed in the interior of the country, and that if I would go with him for a month he thought that he could show them to me. The same man told me curious stories about the existence, in the interior, of a quadruped whose habits he described, and which, if it did really exist at all, must, I think, have been a description of beaver. That fact may possibly tend to discredit his evidence, but I can only say that if it had been possible for me, consistently with my duties at that time, to go with him, I should have been very glad to do so.

The country to which he referred as the interior was the country to the west of the Taieri River, towards the source of that and of the Matou, or Molyneaux. It has, since that time, been fully explored, in consequence of the discovery of gold there, and it does not appear probable that he was correct in supposing that such birds still lived, though there are stories among the early explorers of having seen and heard strange things.

The rarity of these birds was attributed by Teraki and other natives of that district in which they were once abundant to over hunting, and to the fires, which, sweeping across a country covered principally with coarse grasses, had destroyed nests and eggs, and driven the birds themselves into the swamps for refuge, to meet death by suffocation from smoke and water.

Such an explanation appears to me to be probably correct, and the fact that complete skeletons have been found in the Taieri swamp, in a situation to which no existing stream of water could have carried so large a carcase, appears to lend weight to it. I have myself found on the low hills to the south of the river Matou the charred remains of egg-shells and bones of some variety of that genus, but not of the largest. I was instrumental in obtaining the first specimens of bones of such large varieties of the Dinornis as were discovered in the Middle Island. They were procured from a bed of peaty soil beneath the sands at the ancient embouchure of the Waikouaite River near Otakou, on an occasion when extraordinary low tides followed a strong south-east wind. They were forwarded from Waikouaite to Colonel Wakefield, and sent by him to Professor Owen, but there was not among them any complete skeleton, or any complete head.

Halstead WILLIAM DAVISON

The Earthquake at Manilla: its Theoretical Significance

THE first section of my Outline of a Theory of Earthquakes and Volcanic Eruptions,* which appeared in March 1869, concluded with the words, "At the same time we take advantage of this opportunity to refer to the catastrophe which, according to our theory, must occur on the 30th of September or the 1st of October of this year, and to call the attention of the inhabitants of those countries which are more especially exposed to earthquakes—that is to say, equatorial lands, particularly Peru, the East Indies, &c.—to the danger which threatens them." I wrote these words under the immediate impression of the results derived from my strict investigation of the earthquakes from 1848 to 1868—an investigation which awakened in me the firm conviction that the influence of the moon upon earthquakes is an incontestable fact. As these results were then known to me only, the prediction referred to must have surprised those scientific men who may consider themselves authorities on this subject. There was nothing peculiar in this. But the remarkable circumstance was that, although *before* the 1st of October not a single voice was raised against my theory, after that day (which passed in Peru without an earthquake) there appeared in the *Cologne Gazette* an anonymous article laden with the most vehement abuse of myself. I was able to take it quietly, because I knew I was in the right. For I had nowhere mentioned the localities to be visited by the threatened earthquake so exactly, nowhere defined the limits of it so closely, as the public thought fit to assume. In every passage I made use of the *vague* expression, "*Equatorial countries*," adding, by way of example, Peru, Mexico, Equador, the East Indies, &c.; in fact, at present, my theory does not admit of my explaining myself otherwise. People overlooked, or wished to overlook, the fact that in this case stress was laid upon *the time* and not *the place*. In the same way the earthquake in the Rhine country on the 2nd October, and the devastating outbreak of the volcano Puraie in Columbia on the 4th October,† were passed over with the most marvellous silence. I comforted myself, however, with the hope that later intelligence would afford me satisfaction, and I was not mistaken. Early in November a telegram announced that a "severe earthquake" had caused great destruction in Manilla; still no date was added, and for a few days I was only able to say that I supposed this earthquake took place on the 1st October. (See "Sirius," vol. iii. p. 7.) But the *Bulletin Hebdomadaire*, of the 9th January last, brought the following decisive intelligence of extraordinary importance for the earthquake theory:—"We learn from the *Courier* of the Philippine Islands that an earthquake took place at Manilla on the 1st October last. It was about half-past eleven in the morning when the first shocks were felt. Then followed the most frightful oscillations which lasted forty-five or fifty seconds, or, according to other observers, even over a minute. These oscillations were regular measured cadences, and violent, like the rocking of a ship in a storm. According to the indications of the pendulum, they were first in the direction S.E.—N.W., later N.E.—S.W. Many persons became sea-sick. The terror of the inhabitants during these anxious moments was fearful. They thought of the earthquake in the year 1863," &c., &c.

In accordance with the foregoing is the following information in the *Gazette* of the Eastern Seas—"Manilla, Oct. 2: The earth shook during yesterday's earthquake in the most alarming manner, like a ship in a violent storm; walls and beams cracked; all the walls in the rooms showed splits, and the ground was everywhere covered with chalk and mortar. In the garrison town of Manilla itself, the entire façade of the Augustine

* Three sections have appeared up to the present time.

† The newspapers give the following account of the catastrophe:—"Intelligence has been received of a violent eruption of the volcano Puraie in Columbia, accompanied by terrible devastation and loss of human life. Towards three o'clock on the fourth of October, the mountain began with violent eruption to throw up immense masses of ashes and lava. Two or three villages at its foot are said to have been entirely destroyed, with their inhabitants. The water of the River Canoa rose at Popayan a foot above its usual height, and the rapid current thus occasioned brought down lava and the bodies of men and animals from the devastated localities. At eleven o'clock on the morning of the same day the river was almost dried up."

Church is split, but still standing. In the old palace of the Governor, one part of the building fell in. There is hardly a house that has not been more or less seriously injured. The earthquake is said to have been more violent still in the neighbouring places, Balacan and Cavite, where also a lamentable loss of human life took place. Except the first two shocks, with which the earthquake began, the movement of the earth's surface was horizontal, but the *violence was not less than that in the year* 1863. If *the shocks from below* had recurred, Manilla would in all probability have been to-day but a heap of ruins.—3rd October: Yesterday evening, at six o'clock, we had a second earthquake with horizontal movement, and of rather long duration.—4th October: Yesterday evening, at eight o'clock, another earthquake of short duration. The original news from Balacan and Cavite is confirmed: in the first locality nearly all the stone houses fell in; amongst them the church, the town-hall, the parsonage, &c. — 11th October: The shocks were repeated on the two following days—(on the 4th and 5th) so that we have been visited with earthquakes on five consecutive days. Since then there has been quiet. According to the accounts received to-day from the provinces, the earthquake was felt throughout the whole of the Island of Luzon, that is to say, over an extent of country six times larger than Wales. The earthquake is said to have been most destructive in the southern province of Albay." It is evident from all this that we have here no mere ordinary earthquake, but, in point of fact, an event resembling the earthquake of 1863, as expressly observed in the passages cited.

The question will now occur to every thinking man: Is this exact concurrence of prediction with observation only an accident, or the actual expression of a law of nature? Is the circumstance that the catastrophe happened *two hours and a half after the culmination of the Moon*, which took place on that day *in the zenith of Manilla*, only a playful freak of the subterranean goblins, or is it connected with that theory according to which earthquakes occur, under favourable circumstances, at those places situated immediately over the summit of the tidal wave*? He who answers the question without previously examining into the matter, adopts certainly the most convenient method. But such is not the conduct of a friend of truth. I have derived my answer from the investigation mentioned in the commencement of this communication, and believe that what I have published is a sufficient justification for the prediction I have made; at the same time I consider that I may, in reliance upon their professional feeling, venture to demand from the representatives of science that they pass no judgment on my views, without knowing them in their entirety.

Prague RUDOLF FALB, Editor of "Sirius"

Right-Handedness

IF asked what part of the human body seems chiefly affected by advancing civilisation, I would be inclined to reply that it is the right hand.

At first sight the four-handed mammals might be thought to have an advantage; but because four hands are employed both for prehension and locomotion, while in man there is one pair of organs for each, man's two hands are worth more than the ape's four. As man rises from the rudest stages—such as digging roots, hunting, and tending cattle, to arts which are highly mechanical—the right hand becomes a more special and serviceable organ than the left, so that the loss of it to an engraver, a clerk, or an artist, compared to the loss of the left, would be a much more serious affair than it would be to a drover, who could clutch his stick or gesticulate to his dog almost as well with the one hand as the other. Admitting that, physiologically, there is a slight reason for the preference of the right hand, all our tools and fashions lend themselves to encourage its further dexterity. Screws, gimblets, &c., are made to suit the supinating motion of the right hand. Tools of the scissor kind are also made for the right hand, and I have seen a print-cutter's gauge made specially for a left-handed person fetch a very low price when it came to be sold. The slant in writing, the shed of the hair in boys, the manner in which buttons and hooks are placed on clothes, and the system of writing from left to right, all seem related to right-handedness.

* The point of greatest pressure outwards against the earth's crust—such pressure being caused, according to my theory, by the action of the tide of the semi-fluid central mass of the earth—is situated mathematically under the place in the zenith of which the moon is at the time. Local circumstances unfavourable to the occurrence of earthquakes *can*, and in most cases, *will*, modify the observed result, so as to cause it to vary more or less from the mathematical calculation.

In drawing, the pupil is recommended to begin at the uppermost corner on the left hand side, where the ornament is of a small and repeating character, so as to avoid fingering the part already finished. A schoolmaster I knew was able to detect left-handed boys, when they used the pen with the left against orders, by the writing either being straight or sloped the wrong way. Most boys know that it is easier to draw a profile with the face looking towards the left hand; yet on looking over the hieroglyphs in the British Museum the faces will be generally found towards the right. The normal way of writing the hieroglyphs is from right to left, though frequent instances occur of their being written from left to right.

I believe there is a constitutional reason for the preference given to the right hand, but I also believe that habit has strengthened nature's tendency, and that as the touch of the hereditary Hindoo weaver has become proverbially fine, so the aptitude of the right hand over the left is greater, with advancing civilisation, than in a state utterly savage. At that period of a child's life when creeping seems a more natural mode of progression than walking, there is no apparent dexterity in the right hand more than the left, and when man was almost utterly without arts, I can believe his state to have been ambidexter or ambisinister.

The elephant is known to employ one tusk more than another in rooting, &c., and when I asked Sir Samuel Baker which tusk went by the name of the "servant," he informed me that it was the right tusk generally, but the exceptions to the rule were far more numerous than was the phenomenon of left-handedness with human beings.

We have no reliable statistics of the proportion of left-handed persons to right in ancient or in savage nations. If Judges xx. 15, 16, is to have any weight in the matter, the proportion of left-handed in the tribe of Benjamin seems to have been greater than at the present day.

Left-handedness is very mysterious; it seems quite against physiological deductions and the whole tendency of arts and fashion. Prof. Buchanan, of Glasgow, who wrote an able memoir on right-handedness in 1862, thinks that left-handedness may be due to transposition of the viscera, and tells me that his friend Dr. Aitken found such a case. But surely transposition of the viscera must be far rarer than obstinate left-handedness. In cases of left-handed persons which I have examined, the limbs of the left side were proportionally larger, just as those of the right side are in normal cases. I have also found that left-handedness is hereditary. J. S.

The Balance of Nature

PREVIOUSLY to the recent wonderful Spectrum discoveries the sun's energy attracted more attention from *savans*, and many apparently extravagant theories were offered in explanation of this most wonderful of all physical phenomena; it is probable that the few remarks I have to make may appear equally extravagant.

As my intention is to allude more especially to the maintenance of the sun's energy, I will only make a passing observation as to its origin. The two conditions in which we find matter in the solar system are that of orbital motion and central repose; in the latter condition matter exhibits its energy in the form of light and heat; whilst in the former the light and heat are transformed into motion. If the earth was suddenly brought to a condition of rest, its energy, hitherto under the form of motion, would be exhibited as light and heat, and it would in a certain degree be converted into a sun.

If it could be shown that the sun was surrounded by an absolute non-conductor of its forces, it evidently would retain its energy for ever. As there would be no exhaustion, the sensations of light and heat would no longer exist. Now we reasonably believe that all space is filled with a highly elastic fluid or ether—this ether in a state of constant and intense action giving rise to the phenomena of solar light and heat. But if no obstacle existed to check or interfere with this action of the ether, it would, like any other body moving in space, retain its action for ever, without the necessity of a continuously acting agency or cause. If this can be granted, then it follows that the energy of the sun—which may have been necessary in the beginning to give this action to the ether—is no longer exhausted when the ether is once in motion. Hence this active ether is really an absolute preserver or non-conductor of the solar power or force, exhibiting itself as light, heat, &c.

But certain obstacles do exist to check the action of the ether. These are the various bodies which move in space and revolve round the sun, one of which is the earth we inhabit. But the resistance which the earth offers to the motion of the ether is the cause which converts this motion into that which gives the sensation of light, heat, &c., just in the same way that other matter in motion is transformed by resistance into heat and light. A more simple illustration of what I mean would be given by supposing a current of sea-water to give out a phosphorescent light only when an obstacle to its motion is introduced, such as a stone or stick, or when the waves of the ocean give out light by dashing upon a rock or the sea-shore.

From this line of argument it will be concluded that the only causes which exhaust the sun's energy are the several planetary and other bodies, moving in space, upon which the waves of ether dash, thus transforming their energy into the sensational forces of light, heat, &c.; but the area of these resisting bodies is exceedingly small in comparison with the rest of space, in which the ether is acting by its own energy, and without coming in contact with any resisting or exhausting obstacle.

It remains, then, to account only for the amount of the sun's energy which is absorbed or transformed by these planetary and other bodies. Although we may have thus reduced the solution of this mighty problem to a narrower space, yet it is just as difficult to account for the maintenance of the exhausted energy occasioned by a single grain of sand moving in space as by all the planetary and other bodies together.

Seeing that constant exhaustion or transfer of the sun's energy does take place, although in a much less degree than would be the case if it were not confined to the moving bodies in space alone, it remains then to account for its maintenance. The first question we should ask ourselves is this: Is there any evident or known force tending towards the sun as a centre? The immediate reply will be gravitation; and although in the present state of scientific knowledge it may be difficult or impossible to define what gravitation is, yet there cannot be a doubt that it is a force acting on all matter, with a tendency to carry all material bodies direct to the sun. As such force dashes into or upon the sun, it becomes in its turn transformed into light, heat, &c. It is indeed not improbable that future discovery may teach us that gravitation may have its origin from and bear some certain proportion to the resistance presented by the several bodies in space, which are illuminated by the sun's energy; thus establishing the beautiful law of light and heat being transformed into the force of gravitation—gravitation again into light and heat; thus sustaining and maintaining, for all time, the sublime fountain of motion and life, thought, and every sensation and action that organic matter is able to experience. W. L.

Sir W. Thomson and Geological Time

THE strongest statement about the retardation of the earth's motion of rotation by tidal friction, supposing the earth had been for so long a time provided with an ocean, is to be found in the appendix to a sermon preached by Professor Pritchard, F.R.S., then president of the Royal Astronomical Society, before the British Association at Nottingham. He there, in combating Darwin, says, "One million of million years ago, if the solid earth could then have been provided with an ocean, the length of the day would probably have been less than the flash of the hundredth of a second of time!"

I announced to the Literary and Scientific Society of Nottingham that this was an error in calculation, and based on a fallacy in reasoning; and Mr. Pritchard withdrew the result, while maintaining the method, in a letter read to the meeting after a lecture on the subject that I subsequently gave. But I am informed that it has since been republished in its old shape.

There is a still more amazing statement put forward in this appendix by the champion of Anti-Darwinism. Mr. Pritchard says he is familiar with the optical structure of the human eye. He dwells on the wonderful mechanism, and hints at the wonderful chemistry of it; and quotes the well-known passage from Darwin (Ed. I. p. 188) in which, while he gives up all attempt at showing gradation in the structure of the eye of Vertebrata, recent and fossil, yet he shows that in the Articulata the series is more complete. He quotes this, I say, to show that Darwin undertakes to explain by natural selection the structure of the *human* eye, which is precisely what he declines to do. "Let us attend," he says, "to the process of natural selection by which this marvellous organ is said to have come into being." '"I can see," says Mr. Darwin, "no very great difficulty . . . in believing that natural selection has converted the simple apparatus of an optic nerve into an optical instrument as perfect as is possessed by any member of the great Articulate class," i.e. *as perfect as the human eye.*' Is not this amazing?

Rugby, March 22 J. M. WILSON

The Moon's Diameter

WILL you permit me to say a few words on the interesting question raised by Dr. Ingleby in your last? The sun, moon, and all the heavenly bodies appear set, as it were, in the blue sky when the weather is clear; and as they are rarely visible unless when surrounded by at least a small space of blue sky, it seems to me that they will be naturally judged to be at the same distance from us that the sky is. But what is this distance? What, in other words, is the mean distance from which the blue light diffused or reflected from the air or vapour comes to us? Prof. Tyndall, who has devoted much attention to the causes of this blue appearance, may perhaps be able to tell us. The problem, of course, is rather an indefinite one, but an approximate solution might assist us in determining the question.

As to the heavenly bodies appearing larger when nearer the horizon, I shall leave some one else to settle the angular magnitudes in the case. Mr. Abbott, to whom Dr. Ingleby refers, proves that the fact is not confined to the heavenly bodies, but that portions of the sky seen under the same angle appear at least three times as large when near the horizon as when near the zenith ("Sight and Touch," pp. 136-7). But then, does the blue light come to us from the same mean distance when we look towards the zenith and when we look towards the horizon? or does it come from a much greater distance in the latter case, and thus apparently increase the magnitude of a portion of it whose size remains unchanged? In other words, is the sky seen as a hemisphere, or as a much smaller segment of a spherical surface (the observer being at the centre, not of a sphere, but of a small circle, the plane of which coincides with the horizon)? Most persons who look at a clear sky will, I think, adopt the latter alternative. It will be interesting to know if scientific research bears out natural impression in the case.

Other solutions of the difficulty might undoubtedly be proposed. Association of ideas, which is now the favourite device for helping a lame dog over a style, might be called to the rescue, and with some plausibility. Clouds and birds—everything, in fact, that passes above us—are nearest to us and look largest when most elevated. Elevation is thus associated with comparative nearness, and approach to the horizon with comparative distance. It is, however, simpler, if correct, to maintain that we see the sky as it really is, and that the apparent distances and magnitudes of the heavenly bodies are determined by the fact that they appear to be set in the sky, not placed at a great distance beyond it. W. H. STANLEY MONCK

Trin. Coll. Dublin, April 2

Heat Units

THE science of heat, which is capable of being made and is rapidly becoming one of the most exact of the experimental sciences, seems to labour unnecessarily under an excessive variety of units of measurement. At present there are used—

Units of Mass.	Thermometric Degrees.
Grain,	
Pound,	Centigrade,
Gramme,	Fahrenheit.
Kilogramme.	

Whence, evidently, there result *eight* different thermal units, to all of which the common name "unit of heat" is applied, or, at least, names inadequately distinctive. In the face of this it would really seem that some such suggestion as I here proceed to make must eventually be adopted.

Define, first, as follows:—A *therm* is the quantity of heat necessary to raise the temperature of 1 gramme of water from 0° C to 1° C. Secondly, 1 kilotherm = 10 hectotherms = 1000 therms = . , . . . , thus having kilotherm, hectotherm, &c. suggestively corresponding to kilogramme, hectogramme, &c., in name as well as in nature.

Therms and kilotherms, which would probably alone be required in practice, would thus take the place of "thermal units, centigrade," "gramme-water-units," "kilogramme-units of heat," and others more or less lengthy and inexact at present to be found in writings on Heat and Energy.

College Hall, St. Andrew's, April 4. THOMAS MUIR

The Solar Prominences

It may interest some of your readers to hear that the bright lines of the hydrogen "flames" extending beyond the sun's disc can be seen with much less instrumental aid than has hitherto been considered indispensable. I have succeeded in seeing them quite unmistakably by the following very simple means. I fixed one of Mr. Browning's direct vision spectroscopes (having seven prisms) on a board which also carried a two-inch object-glass belonging to a good field telescope. I mounted the instrument thus arranged (shall I say as an altazimuth) on the back of an ordinary bed-room mirror, and directed it at the sun. The slit was set so as nicely to divide the D line, and a blue glass was generally interposed in front of the slit to sift the light. As the image of the sun traversed the slit at intervals, the flames appeared as bright prolongations of the F line extending beyond the sun's limb. It was also clearly seen at times that these prolongations were narrower than the F line and were not in the centre of it, also that they were frequently detached from the sun's limb, and sometimes they were not straight: appearances depending as is generally supposed on the velocity and pressure of the gas in the flame. The flames were also readily seen in the C line. In observing the solar spectrum I have found coloured glasses in front of the slit very useful to shut out as much as possible of the light from the parts of the spectrum not under observation. By using the spectroscope without its slit and collimating lens, and directing it towards the great nebula in Orion, it shows close together three bright images of the nebula exhibited on a continuous spectrum.

Streatham Hill, April 8. ERNEST CARPMAEL

Modern Geometry and the University of London

THE letter entitled "Euclid as a Text-book," which appeared in last week's NATURE, seems to me to call for immediate reply. Many students about to present themselves for examination at the University of London and other places during the next year have been told by their tutors that a thorough and accurate knowledge of geometry would be better appreciated than the power to make verbal transcriptions of Euclid; and the letter referred to is calculated to shake the confidence of such students in the method they have been advised to pursue, and to produce a feeling of uncertainty as to the way in which demonstrations differing from Euclid's will be received by the examiners. But I think that an inspection of the calendars will re-assure them, and show that they have no cause to fear the result of examination, especially when the University of London is the examining body.

The papers consist of certain propositions common to Euclid and modern text-books, and a number of problems readily solved by a student of modern geometry, but almost impossible to one who has simply committed to memory Euclid's text. My own strong conviction is, that the latter would find some difficulty in passing the recent examinations. The questions given fall strictly within the University programme, and treat of important properties of geometrical figures which no student possessing a knowledge of approved modern methods could possibly be ignorant of. The "alternative" or modern side has been carefully kept in view and placed on a footing of equality with the ancient system.

During the year 1869 eight of my pupils who had *not* read Euclid were candidates for matriculation; all passed, and none were placed lower than the first class; so that I cannot see the advisability of boys returning to Euclid "in order that their prospect of good places may be enhanced."

Mr. Tucker apparently desires a series of questions which could only be answered on modern principles. This would amount to a system of protection, and could not fail to be objectionable.

The student of the New Geometry has, in fact, a great advantage. To the learner of Euclid a fact clothed in terms slightly varying from Euclid's is often new and startling, but to the modern student who learns every proposition in its most general form, and assimilates the idea apart from the external or verbal form in which it may accidentally be presented, it is already familiar and trite. The statement that a change in the London syllabus has been or will be made "as a sop to Cerberus," will strike many as singularly infelicitous and ungenerous. The Senate of the University does not say one thing and mean another; it has always shown unflinching courage in the reform of English methods of education, legislating as an initiator rather than as a follower. The tendency of the University throughout its existence has been to discourage cramming in every shape and form, in the teeth of numerous difficulties and influences to which the term "obstructive" rightly applies rather than to the University itself. It is to be regretted that a letter dating from University College School should show so little confidence in the intrinsic superiority of modern methods, and still more that it should impeach the integrity of men who have not so deserved.

Brixton, March 28 RICHARD WORMELL

DEATH OF PROFESSOR MAGNUS

On the 4th of April, 1870, at a quarter-past 10 p.m., died peacefully, after a long illness, Dr. Gustav Magnus, Professor of Physics, and Director of the Physical Cabinet in the University of Berlin. He was an experimental philosopher of great and varied excellence, executing his work with the choicest apparatus and with the most conscientious care. His numerous labours are known to all students of physics, and they are such as to secure for him an enduring fame. On the 28th of April, 1851, I first saw Professor Magnus on his own doorstep in Berlin. His aspect won my immediate regard, which was strengthened to affection by our subsequent intercourse. He gave me a working place in his laboratory, and it was there I carried out the investigation on Diamagnetism and Magne-crystallic Action, which is published in the *Philosophical Magazine* for Sept. 1851. In 1853 I was again in Berlin, and found under his roof the same ready help and sympathy. Professor Hirst and myself paid him a visit last summer; and he afterwards attended the Exeter Meeting of the British Association, where his frank, genial, and gentlemanly demeanour were conspicuous to all. Over and above his direct contributions to Science, Prof. Magnus exercised a powerful indirect influence, through the kindly aid and countenance which he lent to young inquirers. When I bade him good-bye in 1851 his last words to me were, "If you should meet any really able young fellow, willing to work, and to whom such assistance as I can render would be valuable, send him to me." There are many such, now no longer young, who, like myself, will mingle a grateful memory of his goodness with their grief for his loss.

Royal Institution, 11th April JOHN TYNDALL

*THE SOURCES OF THE NILE**

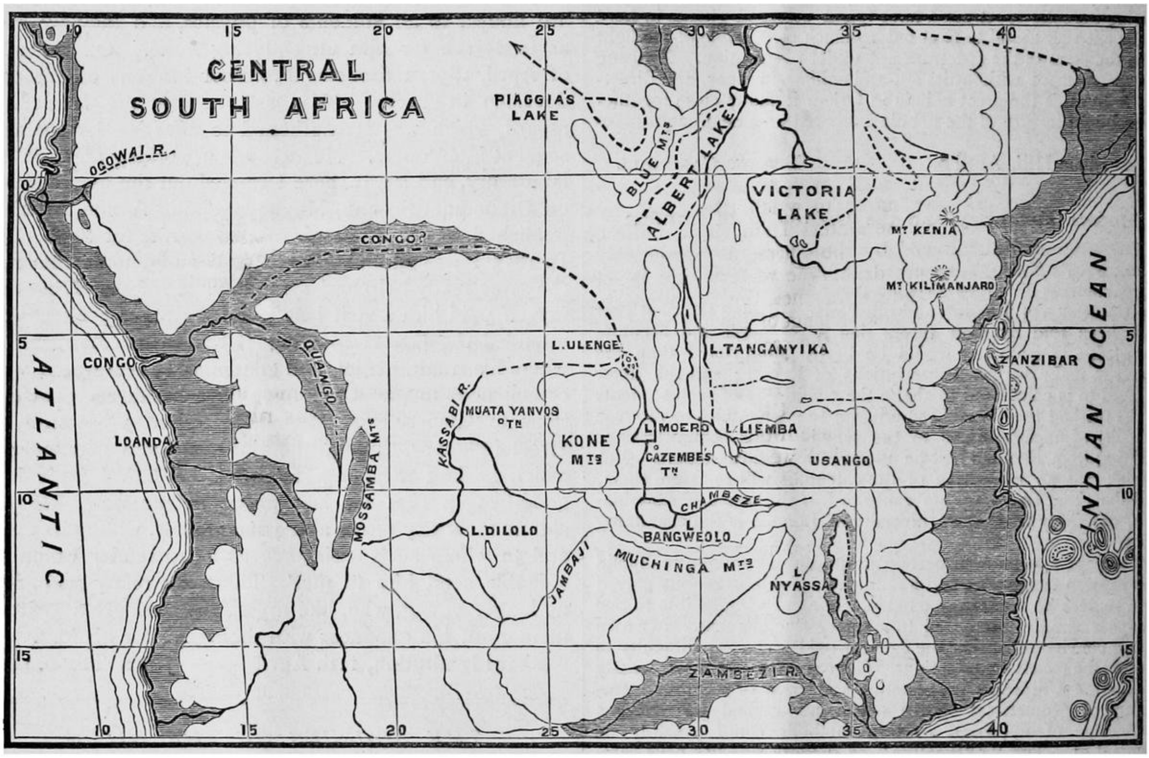
The main point of interest in the latest travels of Livingstone, and that which gives to them a distinctive importance over the great accomplishments of his former journeys, is, that in these, Livingstone has undoubtedly visited and beheld the long-sought-for sources of the Nile. It is true that there still remains considerable doubt as to which of the basins that he has explored will ultimately be acknowledged as the cradle of the Nile, but this at least is certain, that the real head streams have been seen by him, and the vexed question has by these explorations resolved itself into a choice between two or perhaps three streams. Livingstone himself has apparently no bias in favour of one or other, so that the discussion is a perfectly open one. The three rival head streams are, first, the feeders of Lake Liemba, and second the Chambeze River and its lake chain, both of which rise near the eastern edge of the great longitudinal plateau of the side of Africa next the Indian Ocean; the third is the source recently claimed for the Nile by

* An abstract of part of a paper read before the Royal Society of Edinburgh, March 21st.

Dr. Beke, in his solution of the Nile Problem, the great* Casai, or Kassabi River, which rises nearer the Atlantic side of the continent.

Of the first of these presumptive sources, the feeders of Lake Liemba, it may be said with almost absolute certainty that they are tributaries of the Nile, and it seems most probable that they are the sources of that river. Livingstone has found these "four considerable streams" flowing into Lake Liemba; a river-like prolongation unites Liemba and Tanganyika, these two lakes appearing thus to be at the same level; then Tanganyika and Nyige Chowambe, which is evidently the Albert N'yanza, are "one water," and that this last is a reservoir of the Nile is undoubted.

The union of the second possible head stream, the Chambeze, with the Nile, is less apparent; indeed the balance of evidence seems to show that it must be the head of another great river of Africa, the Congo or Zaire. If the Chambeze prove to join the Nile, then the streams to Lake Liemba become mere tributaries, since the course of the Chambeze is by far the longer of the two. The Chambeze flows down into the central valley through lake Bangweolo, and then northward through Lake Moero. Livingstone describes Lake Moero as beginning twelve miles below the position of the town of Lunda, the capital of the Cazembe (lat. 8° 40′ S., long. 28° 20′ E.), whose position may be laid down with tolerable accuracy from the former journeys of the Portuguese travellers. Since Livingstone proceeded north from Cazembe's town along the eastern shore of the Moero in his attempt to reach Ujiji in 1867, the great bulk of this lake must lie to westward of the meridian of Lunda, or about 120 miles west of Tanganyika. Dr. Livingstone has seen the river at its outflow from the lake, and also at the point where it emerged from the crack in the mountains of Rua, when, according to his own observation, the river turned north-north-west to form Ulenge, a third lake or marsh in the country west of Tanganyika. This north-westerly turn would carry the river quite out of the direction of the Nile basin, and the higher side of the continent being to the east, the probability is that the river would continue to curve to the westward. If, however, the Albert Lake prove to have a great south-westerly extension, this one difficulty is overcome. Again, the valley of the Chambeze in the plateau where Livingstone crossed it, is no doubt one of the greatest hollows in the highland, so that the height of the river bed here may be taken at 3,000 feet, the lowest level of the limits which Livingstone gives to the undulation of the plateau, or only 200 feet above Tanganyika. Descending into the "great valley"* to Lake Bangweolo from the plateau, the Chambeze must have a considerable fall, from Bangweolo to Moero there must be a second descent. The Cazembe's country, which extends round to the south of Tanganyika, is described as flat, and its rivers are currentless and stagnant. If Moero were at a higher level than Tanganyika, would not the river which leaves it take a course over this flat country instead of facing towards and making its way through a "crack in the mountains northward?" Seeing that the river does force its way through the mountains of Rua (which appear to be a continuation of the "ranges of tree-covered mountains" which "flank Lake Moero on both sides") the presumption is that Moero is at a lower level than Tanganyika; and if this be the case, the river which descends from it through the mountains cannot ascend to the level of any one of the Nile lakes to join them, but must find some other course. With regard to the third advocated source, the Kassabi River, of which Dr. Beke affirms it to be his belief that it is the head stream of the Nile of Egypt, the difficulties of its joining the Nile appear to be even greater than the last. The upper course only of this river has been explored.



MAP OF EQUATORIAL AFRICA WITH CONTOUR LINES

* *Athenæum* of February 5th, 1870.

* It has been objected that Lake Bangweolo does not lie in a valley, but on the plateau; but Livingstone's letters could scarcely be clearer on this point, since he speaks of "the great valley enclosed between Usango (the eastern plateau) and the Kone range."]

It springs in the Mossamba Mountains, which are on the inner borders of Angola and Benguela, its sources being close to those of the Quango River, a tributary of the Congo. The Kassabi is known to flow northward as far as the 8th parallel of latitude, and to the westward of the capital of the Muata Yanvo, the great negro potentate of Central South Africa. Livingstone crossed its head on his journey from the Zambesi to Loanda, and reports which he collected from the subjects of the Yanvo's kingdom all tend to prove that whatever direction its middle course may take, in its lower course the Kassabi flows round to westward, and is joined by the Quango. The trader Graça, who penetrated to the Muata Yanvo's capital in 1846, says that the territory of this chief is "shut in" by the great rivers Kassābi and Lurua (a tributary of the Kassabi), and he affirms that the Kassabi has an easterly direction beyond this.

The Hungarian traveller, Ladislaus Magyar, has penetrated furthest of the three Europeans who have visited this region, and his report agrees well with this last. He states that the Kassabi, after forming the waterfall of Muewe (in about 11° S.) bends gently to northward, but further on takes an easterly direction in its lower course, and attains a great breadth at the place where it "*touches upon*" the extensive lake Mouva, or Uhanja.* Now if we turn the Kassabi River eastward in latitude 8° south, in agreement with the above description, we find that it meets the position which Dr. Livingstone's letters give to Ulenge, the lake or marsh to which the Chambeze ultimately flows, and whose waters Livingstone tells us by report are "*taken up*" by the Lufira, a "large river which by many confluents drains the western side of the great valley." Is not the Lufira, then, the lower course of the Kassabi River, and Lake Ulenge of Livingstone, the Uhanja of Magyar? If this be the case, the same difficulties which appear in the way of the Chambeze River joining the Nile, hold also against the Kassabi, which would seem to join this river at Lake Ulenge.

Next, the question arises, If these rivers do not form a part of the Nile system, where shall we find an outlet for them? The answer to this is plainly, in the Congo River.

The Congo was described by the Jesuit missionaries who first visited its mouth as "so violent and so powerful from the quantity of its waters and the rapidity of its current, that it enters the sea on the west side of Africa, forcing a broad and free passage (in spite of the ocean) with so much violence that for the space of twenty leagues it preserves its fresh waters unbroken by the briny billows which encompass it on each side." In the introduction to his narrative of the British expedition to the Congo River in 1816, Tuckey says: "If the calculation be true that the Congo at its lowest state discharges into the sea two millions of cubic feet of water in a second, the Nile, the Indus, and the Ganges are but rivulets compared with it, as the Ganges, which is the largest of the three, discharges only about one-fifth of that quantity at its highest flood." This statement may be somewhat exaggerated, but Tuckey actually found that this vast river has a width of two, three, or even four miles, whilst flowing with a current of two or three miles an hour,† and this not at its mouth, but inland beyond the mountainous coast region. The northward wall-like continuation of the Mossamba mountains, on the 20th meridian, to beyond the equator, which Dr. Beke supposes to exist,‡ would not admit of a longer course than about 500 miles for the Congo, and a basin of that extent is utterly inadequate to collect and maintain such a body of water as that which this river is known to have, in a region where the annual rainfall averages only 12 to 15 inches (Livingstone's observation at Loanda). Such a vast river cannot be formed in a short course, but must have its rise far in the interior of the continent; and if the Kassabi River and its drainage be taken to the Nile, where shall we find a sufficiently lengthened course for the Congo?

* Magyar's journey in Petermann's Mittheilungen, 1860.

† P. 342 of the Narrative.

‡ Map to accompany a paper on Dr. Livingstone's discoveries in "Illustrated Travels," Part XV.

Tuckey's unelaborated notes give the opinion that the "extraordinarily quiet rise* of the river (Congo) shows it to issue from some lake which had received almost the whole of its waters from the north of the line;" and again he says, "I cannot help thinking that the Congo will be found to issue from some large lake or chain of lakes considerably to northward of the equator." The reason of Tuckey's supposition that the lakes, which are evidently necessary to maintain the volume of water in the Congo throughout the year, would be found north of the equator, is, that he found the rising of the river beginning on the first days of September. At the time of his journey little or nothing was known of the times of the rainy seasons in Central Africa from actual experience. The observations of travellers in the continent since that time have greatly increased our knowledge of these seasons, and show them to be regulated by the apparent movement of the sun between the tropics. An area of low atmospheric pressure, with its attendant inflowing winds and rains, is constantly moving up and down the part of Africa which lies between the tropics, following the vertical sun. If every part of Africa were level and equally surrounded by water, it would result from this movement of the area of low pressure, that a rainy season would begin at each point shortly after its latitude had passed vertically beneath the sun, and a double rainy season would thus be produced: a *greater* when the low pressure area is moving equatorward in each hemisphere drawing in the sea winds; and a *lesser* when that area is passing north or south outward from the equator towards the extremities of the continent, inducing rather the land winds, whose moisture is already in great part spent. This rule holds good on the low coast lands, where other exterior influences do not disturb the arrangement, but over the high plateau of the interior of South Africa,† the commencement of the rains seems rather to precede than to follow the vertical sun, and in the equatorial regions two of the rainy seasons are prolonged into one, which lasts for eight months of the year. Under the equator at the mouth of the Ogowai River, on the west coast, Du Chaillu found the rainy season beginning in October; farther inland, in the Fan country, the rains set in in September, and in the same latitude, between Victoria Lake and Tanganyika, Burton tells us that the rainy season begins in August. Between 5° and 10° south latitude Livingstone's observation shows that on the west coast at St. Paul de Loanda the lesser rains begin in November, but in the same latitude in the centre of the continent Burton reports the rains of the Tanganyika basin beginning in September, or two months earlier; and Livingstone in his latest journey could not proceed to Lake Bangweolo from the Cazembe's town, where he arrived about the middle of September, because the rains had set in. Lake Ulenge lies between these latitudes, or in about 5° south, so that the rise of the waters of the Congo River, if its upper course be through this lake, is perfectly explicable, without the necessity of taking its reservoir lakes to the north of the equator. The lower course of the Congo is probably in a curve to north-westward from Ulenge, afterward turning south-west to meet the farthest point which Tuckey reached, where it was flowing from north-east. The rains would begin to fill Lake Ulenge, as well as the part of its lower course below this which is in the centre of the continent, in

* The maximum rise of the Congo was observed to be only 11 feet, generally 8 or 9, or less than that of perhaps any river of equal magnitude. That of the Zambezi (above the confluence of the Shirè), a lakeless basin, has been found by Livingstone to be as much as 80 feet perpendicularly; and at Khartoum the White Nile rises nearly 18 feet.

† As also in the Abyssinian highland.

August; lower down still the rains apparently begin in September, but, as before noticed, towards the coast they are later, and so do not begin at the mouth of the river till well on in September, after the river has begun to rise. The dry season in the country west of Ulenge also agrees well with the movements of the Congo river, for Dr. Livingstone remarks that the floods in the country between Moero and Ulenge last till May or June, and the lowest state of the Congo was observed to occur in July and August.

With the Kassabi and Chambeze for its head streams, the Congo has a sufficient, though not too great area of drainage to collect the vast quantity of water which it returns to the ocean. On this supposition the area of its basin measures about 800,000 square miles, and that of the Nile nearly 1,300,000 square miles; so that the great African rivers stand in order thus:—Nile, Congo, Niger, and Zambezi. KEITH JOHNSTON, JUN.

NOTES

WE are informed that the Duke of Devonshire will probably be the President of the Royal Commission to inquire into the Present State of Science in this country.

THERE is so little evidence of scientific training or thought in most things which are done in high places, that it is almost pleasant to be taxed even by a Chancellor of the Exchequer who attempts to do it on scientific principles, or at all events quotes scientific authority as Mr. Lowe does, who, referring to the results of the recent Deep-Sea Dredging Expedition in his Budget speech, compared the British taxpayer to the frail animals which enjoy life at the bottom of the Atlantic at a pressure of three tons to the square inch. We strongly advise Mr. Lowe to sanction another dredging expedition during the present autumn, not that it may be shown how much more vitality there is at a reduced pressure—a vitality more approaching that of "My Lords"—but that even greater pressures may be found and quoted as precedents should the next Budget prove a less satisfactory one. There is a point in the Budget, moreover, of the greatest importance to men of science. The postage on printed matter not exceeding 2 oz., and on newspapers not exceeding 6 oz., is to be reduced to one halfpenny. We have waited a long time for this change: not too long, however, to welcome it warmly now it has come, for the tax on all authors of the postage of scientific papers, copies of which they wish to distribute, has been very great.

THE following are the lecture arrangements at the Royal Institution after Easter:—Four lectures by Prof. Blackie on the Principles of Moral and Political Philosophy, on Tuesdays, April 26th to May 17th. Seven lectures by Prof. Tyndall (subject not announced), on Thursdays, April 28th to June 9th. Seven lectures by Prof. Robert Grant, on Comets, on Saturdays, April 30th to June 11th. Three lectures by Prof. Seeley on History, on Tuesdays, May 24th to June 7th. The *probable* arrangements for the Friday evening meetings are as follows, viz.: April 29th, Prof. Blackie—The Interpretation of Popular Myths. May 6th, Mr. R. A. Proctor—Star Grouping, Star Drifts, Star Mist. May 13th, Rev. Canon Moseley—The cause of the Descent of Glaciers. May 20th, Prof. Williamson—On Atoms. May 27th, Principal Dawson—The Primitive Vegetation of the Earth. June 3rd, Prof. Max Müller—The Migration of Fables. June 10th, Prof Odling (subject not fixed).

THE *Pall Mall Gazette*, which gives so much space to all matters of scientific or general interest, quoting from the St. John's (New Brunswick) *Telegraph* of the 18th of March, describes an extraordinary phenomenon which took place in the harbour of that city on the previous day. Early in the morning, just before the commencement of a snowstorm, while the wind was rising so as to be heard within doors, a strange noise, similar to that accompanying the earthquake on the 22nd of October last, was heard by the residents near the harbour. It was then seen that the old ferry, which should be several feet above water, had vanished. A piece about twenty feet by seventy broke off and settled squarely down into the water. A frontage several hundred feet in extent, running from the line of the demolished wharf towards the breakwater, had also gone down, leaving a steep embankment. The soundings since made show that where the old ballast or reefer was the day before, rising above the water eight feet, were found six fathoms of water, the bottom had settled just thirty-two feet. Near where the portion of the wharf settled away, or where a moderately sized vessel used to ground at low water, there is now between six and seven fathoms at low tide. One of Messrs. Adams's buoys, moored about four or five hundred feet from the shore, had disappeared; and last evening, when the tide was at its lowest level, the current was just showing a ripple over the top of it. As the tides rise and fall about thirty feet in St. John's harbour, and the chain of this buoy had several fathoms of scope, it may be inferred that the bottom sank as much as nine or ten fathoms at this point. So far as could be ascertained, the *Telegraph* states this subsidence took place over an area of about three acres in extent.

MR. ARCHIBALD GEIKIE, F.R.S., the director of the Geological Survey of Scotland, is now at the Lipari Islands, his object being to study the volcanic phenomena of those Islands, and of some adjacent parts of Italy. He anticipates that the numerous coast sections of these islands will furnish evidence from which light may be thrown on the history of the volcanic rocks of the British Islands; the manner in which different volcanic rocks yield to the forces of denudation, subaerial and marine, is also a matter of importance that will be carefully studied.

ON Monday evening a distribution of prizes (certificates of merit) took place at the South London Working Men's College, Professor Huxley being in the chair. Previous to the distribution a lecture on the "Biography of a Plant" was given by Mr. Harland Coultas. Professor Huxley, in the course of his remarks, said that they had presented to them an analogy between vegetable and human life, and that analogy he would carry a little further, by reminding them that there was nothing more poisonous or dangerous than an uncultivated mind. He hoped that these educational establishments would do for society what the plant does for the air; namely, absorb all the poison of ignorance, and, by a similar change to that exercised in the chemical action of the plant, give off those benefits which education alone could diffuse.

IT is not often that the daily newspaper press invades a college in search of an editor, and still less often is a learned scientific professor the elect one. We have a case in point, however, of such a condition of things. Professor Jack, M.A., who has for several years held the chair of Natural Philosophy in Owens College, Manchester, has been requested, and has consented, to take the editorial management of one of the oldest and most successful papers north of the Tweed, the *Glasgow Daily Herald*, a paper which frequently discusses scientific subjects with a fulness of knowledge. Mr. Jack has not hitherto been in the toils of daily newspaper life, but he ought to have no mean qualifications for his new vocation, considering the literary and scientific culture and worldly experience which he has acquired as an alumnus of Glasgow College and of St. Peter's College, Oxford; as one of Her Majesty's Inspectors of Schools in the West of Scotland, and as a scientific professor in Cottonopolis.

THE wave of low temperature which passed over the South of England during the latter half of March, was a very remarkable one. From the 22nd of March till the 6th of April the thermometer fell below the freezing point every night, with scarcely any intermission. For the week ending April 2nd the mean temperature at Blackheath was 37·2°, or about 8° below the average of the corresponding week in the last fifty years. From the reports for sixteen different stations in England, eight in Scotland, and one in Ireland, forwarded every week by Mr. Glaisher to the *Gardener's Chronicle*, it appears that the temperature was much lower in the South than in the North of England, or in Scotland. The lowest averages are given at Portsmouth and London (Blackheath); the highest for England at Liverpool, Salford, and Newcastle; while these latter are several degrees lower than the lowest mean in Scotland. The average temperature for that week in London was 7° lower than in Edinburgh, and 11° lower than in Dublin.

MR. SYMONS's "British Rainfall for 1869" contains an enormous mass of information respecting the distribution of the rainfall throughout the kingdom during last year, with other meteorological statistics. The extremes of rainfall during the year at the places of observation in England were 198·19 in. at the Stye, in Cumberland, and 20·09 in. at North Sunderland, while many places in the south-east of Scotland enjoy even a dryer climate, the fall at East Linton, Haddington, being only 15·77 in. So much injury is done to science by the publication of statistics based on incorrect data, that Mr. Symons's "Rules for Rainfall Observers" should be in the hands of every-one who possesses a rain-gauge.

M. BOURLOT, Professor of Mathematics in the Lyceum at Colmar, believes he has established the fact, contrary to the opinion of Arago, that during the Middle Ages the climate of Alsace was milder than at present. He traces a relation of chronological coincidence, if not of cause and effect, between the change of climate and the precession of the equinoxes.

THE honour of knighthood has been conferred on Mr. Ronalds for his early researches in telegraphy.

THE execution of the Faraday memorial has been committed to the well-known sculptor, Mr. Foley.

PROF. TYNDALL's most recent contribution to the "germ-theory" is contained in a letter to the *Times* of the 7th instant. He has observed that the air breathed out of the lungs, especially at the close of a long voluntary exhalation, is "visibly pure," or produces, when passed across a strong beam of light, the familiar black smoke-like clouds caused by the entire absence of organic matter. He confirms the explanation given by many medical men, and especially by Prof. J. Lister, of Edinburgh, for the exclusion of air from fresh wounds, that the putrefaction of wounds is caused by the germination of the germs of organic life contained, under ordinary circumstances, in large numbers in the air. In a reply to this letter in the *Times* of yesterday, Dr. H. C. Bastian makes the startling assertion that, in conjunction with Dr. Frankland, he has met with living organisms in hermetically-sealed vessels, from which all air had been removed, and after the contained fluids had been raised to a very high temperature. Some solutions containing organic matter and other ingredients were prepared in the following manner:—After a perfect vacuum, above the level of the fluid, had been procured in the glass vessels by means of Sprengel's air-pump, the drawn-out necks of the flasks were closed by means of the blow-pipe flame. The airless flasks, containing then the fluid itself as the only possible germ-containing material, were submitted, in a suitable apparatus, by Professor Frankland, to a temperature varying from 148° C. to 152° C. for four hours, and yet, after having been placed under the influence of suitable conditions, in the course of a few weeks, living organisms—many of them altogether new and strange—were found in these fluids. These extremely important results are about to be communicated to the Royal Society.

THE *Soirée* of the Royal Microscopical Society to be held at King's College on the 20th inst., seems likely to be supplied with a large number of objects of interest. Mr. Charles Stewart prints a descriptive catalogue of 100 microscopic objects selected to illustrate the Invertebrate sub-kingdom, to be exhibited on that occasion.

IN an article in the *Artizan*, for April, on the Influence of the Suez Canal on Trade with India, Sir Frederick Arrow states that at the present moment the influence of the Canal is being felt in a decrease of the cost of fuel east of the Isthmus, which will certainly have a great effect on the cost of carriage, and therefore on the cost of laying down produce and goods. The existence of the route, he believes, will stimulate production, not only in India, but in the various countries which it brings into the family of commercial relations.

ON the 12th of March, the *Hougli*, one of the largest of the packet-boats belonging to the Messageries Impériales, of 2,000 tons burden and 500-horse power, entered the quarantine port of Frioul direct from the China seas, having traversed the Suez Canal without encountering the slightest obstacle. The cargo consisted of 1,300 bales of silk, 300 chests of tea, and other valuable freight, and there were in addition seventy passengers.

WE learn from Mr. Worthington G. Smith, in reference to a recent report of the proceedings of the Woolhope Naturalists' Field Club, that he has in preparation a *Clavis Agaricinorum*, which will be an analytical key to the genera and sub-genera of the British *Agaricini*; designed to give an immediate clue to their proper generic and sub-generic position, and thus assist in their ultimate determination.

MR. BENTLEY announces for early publication, "Travels in the Air," by Mr. Glaisher and others, with numerous full-paged coloured lithographs and woodcuts.

A NEW work is preparing for publication by Arthur Scott Donkin, M.D., Lecturer on Forensic Medicine to the University of Durham, &c., being a history of the British Diatomaceæ, with plates illustrative of each species.

THE *New York Technologist*, a new magazine especially devoted to engineering, manufacturing, and building, published in New York, describes a new contrivance for preventing people looking into a room, while light is not excluded. It consists of a number of glass rods arranged either vertically or horizontally, and secured together by appropriate frames, forming a series of cylindrical lenses which break up the light and throw it into every part of the room, thus producing a soft and diffused glow which is very beautiful and pleasant. The glass rods may be of any colour, and by an arrangement of the colours very beautiful effects can be produced. The contrivance is the invention of Mr. Demuth.

THE Pharmaceutical Society offers a silver medal for the best Herbarium collected in any part of the United Kingdom between the 1st of May, 1870, and the 1st of June, 1871, to any associate, registered apprentice, or student of the society, not over thirty-one years of age.

THE *Photographic Art Journal*, No. 2, is a very good number. It contains four excellent illustrations: "The Stirrup Cup," from a painting by Verschur, exquisitely soft in tone, done by the Woodbury process; "Netley Abbey," by Mr. Edwards's new process of printing in printing-ink in a common printing press, which seems to give exceedingly good results; "The Muleteer's Love," an example of Mr. Fruwirth's phototype process, also pulled in a common printing press, from an electrotyped surface-block which was reduced from a woodcut by the sole action of light and chemical agents; and "A Village Street in Switzerland," apparently an ordinary silver-print. The comparison of these photographs certainly gives the palm to the new processes, both as to distinctness and softness of tone.

ON THE MADREPORARIA DREDGED UP IN THE EXPEDITION OF H.M.S. "PORCUPINE."

In continuation of Dr. Carpenter's Report of the *Porcupine* Dredging Expedition, we now present our readers with an abstract of a paper by Prof. Duncan on the Corals dredged up during the voyage.

Professor Wyville Thomson, Dr. Carpenter, and Mr. Gwyn Jeffreys have placed the collection of stony corals dredged up by them in the *Porcupine* Expedition in my hands for determination. They have kindly afforded me all the information I required concerning the localities, depth, and temperature in which the specimens were found. My report has been rendered rather more elaborate than I had intended in consequence of the great consideration of Professor A. Agassiz and Count de Pourtales in forwarding me their reports* and specimens relating to the deep-sea dredging off Florida and the Havana. They have enabled me to offer a comparison between the British and American species, which I did not hope to have done before the publication of the species noticed, but not described, in this report.

I. List of the species, localities, depths, temperatures.
II. Critical notice of the species.
III. Special and general conclusions.

I. Twelve species of *Madreporaria* were dredged up, and the majority came from midway between Cape Wrath and the Faroe Islands. Others were found off the west coast of Ireland. Many varieties of the species were also obtained, and some forms which hitherto have been considered specifically distinct from others, but which now cease to be so.†

II. Three species were found, known only on the area dredged, or in the neighbouring seas. Three species common to the area and to the Florida and Havana deep-sea faunas only. (These forms are not known in the West Indian Cainozoic fauna, and they have not been discovered in any European deposits.) *Lophohelia prolifera* (var. *affinis*) is common to the British and Florida deep-sea faunas; but it is found fossil in the Sicilian tertiaries, being moreover a member of the Mediterranean recent fauna. Three species common to the area and to the Mediterranean Sea. Five species found on the area dredged, and as fossil elsewhere.

The deep-sea coral fauna of the area dredged in the *Porcupine* and *Lightning* expeditions is therefore composed of—

5 species which have lasted since the early Cainozoic period.
1 Mediterranean species not known in Cainozoic deposits.
3 species of the deep-sea fauna of Florida and Havana.
3 indigenous species.

Two of the fossil species are represented in the recent Mediterranean fauna. If the species which I have absorbed into others (in consequence of the light thrown upon the amount of variation in the deep-sea corals) were counted, the fossil forms would be in all eight. The greatest depth from which *Madreporaria* were dredged was 705 fathoms, and the lowest temperature of the water in which they lived was 29°·9.

Caryophyllia borealis, Fleming.—Having collected a very considerable series of the *Caryophylliæ* from the seas around Great Britain, and having been supplied with several specimens of the Mediterranean species, I had compared the whole with the fossil forms from the Sicilian tertiary deposits and with each other. The numerous specimens of *Caryophylliæ* dredged up in Dingle Bay were especially interesting after I had arrived at satisfactory conclusions respecting the affinities of the above-mentioned British and southern European forms. The Dingle Bay collection presented all the varieties of shape, some of which had been deemed of specific value, which I had observed in the separate assemblages of specimens from the Mediterranean, the Sicilian tertiaries, and the British and Scottish seas. A perfect series of specimens from all these localities can be so arranged as to show a gradual structural transition from form to form, so that the most diversely shaped *Caryophylliæ* can be linked together by intermediate shapes. The *Caryophyllia clavus* and *Caryophyllia cyathus* can be united by intermediate forms, and all of these to *Caryophyllia Smithi* and *Caryophyllia borealis*. It is impossible to determine which is the oldest form, but they all appear to be reproduced by variation on some part of the area tenanted by the section of the genus. The variability of the *Caryophylliæ* of the Sicilian tertiary deposits is very marked, and it is equally so in the groups which live on disconnected spots in our waters. The Dingle Bay series presents the greatest amount of variability, and indeed is most instructive, for by applying the range of it to the classification of such genera as *Trochocyathus* and *Montlivaltia* a great absorption of species must ensue. The Dingle Bay *Caryophylliæ* are evidently the descendants of those which lived in the western and southern European seas before those great terrestrial elevations took place which were connected with the corresponding subsidence of the circumpolar land and the subsequent emigration of Arctic Mollusca. They are not closely allied to the recent West Indian species, but they occupy a position in the coral fauna representative of them. The same remark holds good with reference to the affinities of the recent and the cretaceous *Caryophylliæ*. They are not closely allied, and they belong to different sections of the genus, but in the economy of the old and new distribution of animal life they hold the same positions, and the recent forms are representative of the older. The Dingle *Caryophylliæ* prove the purely arbitrary nature of species, and that what we term one is really the sum of the variation of a series of forms.

Ceratocyathus ornatus, Seguenza.—A beautiful specimen of this rare form was dredged up from a depth of 705 fathoms with some *Caryophyllia* and a small *Isis*. The species is hitherto unknown except in the Sicilian miocene.*

Flabellum Sarsii, Sars, sp.—This is the *Ulocyathus arcticus* of the late Prof. Sars. Many specimens were dredged up, but most of them were broken in consequence of the extreme fragility and delicacy of the theca. The species links *Flabellum* to *Dermophyllum*: it is not known in the recent Mediterranean fauna.

Lophohelia prolifera, Pallas, sp., is apparently a common coral in the north-western British seas. A separate corallum, which must be referred to *Lophohelia anthophyllites*, Ellis and Solander, was dredged up in No. 54. *Lophohelia prolifera* exists in the Mediterranean Sea and the sea between Scotland and Norway. *Lophohelia anthophyllites* is an East Indian form, but its absorption into *Lophohelia prolifera* suggests explanations, considering the Cainozoic progenitor, and how it migrated eastwards. The relation of the recent East Indian coral faunas to those of the European and West Indian Cainozoic deposits has been noticed and admitted for some years past. The Cainozoic *Lophohelia* of Sicily is the earliest form of the genus, and those which are found in such remote parts of the world as the East Indies, the Florida coast, the Norwegian coast and the Mediterranean, and which have been determined to belong to different species, are, from the study of the curious assemblage of variable forms now under consideration, evidently varieties of the old type, *Lophohelia prolifera*. I have therefore absorbed the old species *L. anthophyllites*, *L. subcostata*, *L. affinis*, *L. Defrancei*, and *L. gracilis*. Two genera of the *Oculinidæ* in the classification of MM. Milne-Edwards and Jules Haime have always been most difficult to distinguish; and now the results of the dredging off the north of Scotland and off Florida and the Havana necessitate the absorption of one of them.

Amphihelia and Diplohelia.—The first, containing recent species only at the time of the enunciation of the classification just referred to, and the last, having fossil species only, were very likely to be considered separate genera. *Diplohelia* had species in the Eocene seas and in the Cainozoic also. *Amphihelia* was known to have species in the Mediterranean fauna, and in that of Australia also. Seguenza, however, described some *Amphiheliæ* and *Diploheliæ* from the Sicilian tertiary deposits which were identical, so far as generic attributes are considered, the only distinction being a doubtful raggedness of the septal edges. The habit and the method or growth and gemmation of the forms were the same. M. de Pourtales dredged up a branching form from off the Harena in 350 fathoms, and from off Bahia Houde, near Florida, in 324 fathoms, and also in lat. 28° 24′ N., long. 79° 13′ W., in 1,050 fathoms (came up with the lead). This he named *Diplohelia profunda*. On referring† to Seguenza's plates and descriptions of the fossil corals from the Sicilian tertiary deposits, there is no difficulty in deciding upon the very close affinity of the species described by Pourtales and *Diplohelia Meneghiniana*, Seg., and *Diplohelia Doderleiniana*, Seg., fossil forms from the mud-tertiary deposits. But on comparing these

* Contributions to the Fauna of the Gulf Stream at great depths by L. F. de Pourtales, 1st and 2nd Series, 1868. Bull. Mus. Comp. Zool., Harvard College, Cambridge, Mass., Nos. 6 and 7.

† One specimen came from the *Lightning* Expedition. It must be remembered that all the deep-sea corals known to British naturalists weren ot dredged up. The *Stylaster rosea*, for instance, was not amongst the collection.

* Seguenza, "Disquisiz. Paleont. int. ai Corall. Foss.," Mem. della Reale Accad. dell. Sci. Torino, serie ii. tomo xxi. 1864.

† Seguenza, "Disquiz. Paleont. int. ai Corall. Foss.," Mem. della Reale Accad. dell. Sci. Torino, serie ii. tomo xxi. 1864.

forms with one exquisitely figured by Seguenza, and which he calls *Amphihelia miocenica*, Seg., the generic affinities of all become startlingly evident. The very numerous specimens of small branching *Oculinidæ*, which were dredged up in the *Porcupine* Expedition (No. 54) and to the north-west of the spot in the cold area, at a depth from 363 to 600 fathoms, present singular variations of structure in the buds and calices upon the same stems. A careful examination of them, assisted by a comparison between them and the well-known recent and fossil *Amphiheliæ*, the fossil and recent *Diploheliæ*, and the smaller specimens of *Lophoheliæ*, leads to the belief that *Amphihelia* is identical generically with *Diplohelia*, and very closely allied with *Lophohelia*. Indeed, the distinction between the *Lophoheliæ* and *Amphiheliæ* is of the slightest kind. The species of the genus *Amphihelia* dredged up in the *Porcupine* Expedition are numerous :—

1. Amphihelia (Diplohelia) profunda, *Pourtales*, sp.
2. —— oculata, *Linneus*, sp.
3. —— miocenica, *Seguenza*.
4. —— Atlantica, *nobis*.
5. —— ornata, *nobis*.

The distinction between these massive and densely hard corals (whose calices are principally on one side of the cœnenchyma of the stem) and the *Stylasters* is very evident. M. de Pourtales has described a pretty red-coloured *Allopora miniata* dredged in 100 to 324 fathoms off the Florida Reef; but it is very distinct from the species discovered in the late deep-sea dredging expeditions. *Allopora* has no fossil representatives.

Balanophyllia (*Thecopsammia*) *socialis*, Pourtales.—Six specimens of a simple perforate coral were dredged up in lat. 59° 56′ N., long. 6° 27′ W., 363 fathoms, temperature 31°·8 (No. 54), and one in lat. 61° 10′ N., long. 2° 21′ W., 345 fathoms, temperature 29°·9 (No. 65). The six specimens are of different sizes and ages; and although they present considerable variation in shape and septal development, they evidently belong to one type. The solitary coral form (No. 65) is larger than the others, but it belongs to the same species. Notwithstanding the temperature in which the corals were found, and the depth of the sea, they are strong and well-developed forms, evidencing an active and abundant nutrition. There is no difficulty in classifying the specimens with the *Thecopsammiæ* of Pourtales. *Thecopsammia socialis*, Pourtales, was dredged up in from 100 to 300 fathoms, off Sombrero, near Florida, in the course of the Gulf Stream.

The varieties and the original type are very isolated forms in the great genus *Balanophyllia*. They have only a very remote affinity with the West Indian recent *Balanophylliæ*, with those of the Crag, the Faluns, and the Eastern tertiaries. The British forms appear to have emigrated from the south-west, and probably the original type wandered, through the agency of the Gulf Stream, which carried ova and deposited them in our northern sea, where they have propagated, varied, and thriven.

Pliobothrus symmetricus, Pourtales.—A specimen of this doubtful coral, which had been described by M. de Pourtales, from the results of dredging in from 100 to 200 fathoms, was sent to me by Dr. Carpenter. It came from the cold area, in from 500 to 600 fathoms. There is no doubt that this very polyzoic-looking mass belongs to the American type. The tabulæ are hardly worthy to be called such, and I place the form amongst the Zoantharia provisionally.

III. The species of *Madreporaria* belong to genera which do not and have not contributed to coral-reef faunas. None of them are reef-builders; but all are essentially formed to live where rapid growth and delicately cellular structures are not required. The forms are strong, solid, and large; and their rapid and repeated gemmation proves that their nutritive processes were active and continuous. All the species are very much disposed to produce variations; and this is especially true as regards those which have outlived the long age of the crag, the glacial period, and the subsequent time of elevations and subsidences. The least variable species are those which are not known on other areas. Two of the three species which are common to the West Indian deep-sea fauna and that of our north-western coasts are also variable. The persistence of *Madreporaria*, from the earlier Cainozoic period to the present time, has been an established fact for several years. Some of the forms which are common to the deep sea of the British area and to the so-called miocene of Sicily, are still existing in the Mediterranean. None of the species of corals found in the British crag are represented in the deep-sea fauna. The existence of Mediterranean forms in the north-west British area is in keeping with the discoveries of Forbes. It has, however, a double significance, and bears upon the presence of West Indian forms on the north-west British marine area. There was a community of species between the Mediterranean and the West Indies in the Cainozoic period, and especially of Echinodermata, Mollusca, Madreporaria, and Foraminifera. After the great alterations of the mutual relations of land and sea which took place before the cold affected the fauna of the Franco-Italian seas, this community of species diminished; but it lasted through all the period of northern glacialisation, and is proved still to exist slightly by comparing the Algæ, the corals, the Echinodermata, and the Mollusca. The presence of two very characteristic Floridan species, and one less so, off the north of Scotland, is particularly interesting, because they all live in the cold area and flourish there; whilst they appear to be less vigorous in the warmer Gulf Stream near Florida. It is impossible to fail to recognise the operation of this stream in producing the emigration of these three species, which are essentially American. It must be remembered, however, that the Cainozoic *Balanophylliæ* were very numerous in the European area, but not in the American. The solidity and the power of gemmation of the corals within the cold area appear to be greater than elsewhere. Depth does not appear to have much effect upon the nutrition of the *Madreporaria*; for those dredged up at 600 fathoms are quite as hard and solid as those dredged up at 300 fathoms. All the calices were stuffed with small Foraminifera, and there was evidently a great abundance of food.

There were numerous polyzoa, sponges, Foraminifera, Diatomaceæ, and delicate bivalves associated with or fixed upon the corals at all depths. Moreover, at from 300 to 400 fathoms a perforating mollusc had worked its way up the stems of some of the hardest specimens of *Amphihelia* and *Lophohelia*. One had left its excavation, which had been taken possession of by a small Brittle Star, and at a depth of 705 fathoms there was a pretty Isis. *Serpulæ*, moreover, abound upon the corals. This is a fauna which, if covered up and presented to the palæontologist, would be, and would have been for some years past, considered a deep-sea one. It is a fauna which indicates the existence of the same processes of nutrition and of destructive assimilation and reproduction which are recognised in association with corresponding forms at less depths and in higher temperatures. The great lesson which it reads is, that vital processes can go on in certain animals at prodigious depths and in considerable cold, quite as well as in less depths and in considerable heat. It suggests that a great number of the Invertebrata are not much affected by temperature, and that the supply of food is the most important matter in their economy.

The researches of the naturalist who obtained Polyzoa and Foraminifera in soundings at a depth of nearly 400 fathoms off the icy barrier of the South Pacific, of Wallich in the Atlantic, and of Alphonse Milne-Edwards in the Mediterranean, have had much influence upon geological thought in this age, which, so far as geologists are concerned, is remarkably averse to theory. For many years before any very deep soundings had been taken with a view of searching the sea-bottom for life, geologists had more or less definite opinions concerning the deposition of organisms in sediments at great depths. Certainly, more than thirty years ago, deep-sea deposits were separated by geologists from those which they considered to have been formed in shallower seas. The finely-divided sediment of strata containing Crinoids, Brachiopods, Foraminifera, and simple Madreporaria, was supposed to have been deposited in deeper water than formations containing large pebbles, stones, and the mollusca, whose representatives now live in shallows. The relations of such strata to each other, the first being found to overlap the last, proved that there was a deeper sea-fauna in the offing of the old shores tenanted by littoral and shallow-water species. The deposition of strata containing Foraminifera, Madreporaria, and Echinodermata, whose limestone is remarkably free from any foreign substances, has been considered to have taken place in very deep water; this theory has been founded upon the observations of the naturalist and mineralogist. Indeed, no geologist has hesitated in assigning a great depth to the origin of some deposits in the Laurentian, Silurian, or in any other formation. The "flysch," a great sediment of the Eocene formation, has been considered to have been formed at a great depth and under great pressure. Its singular unfossiliferous character was supposed to be due to the absence of life at the depths of the ocean where the sediment collected. But this was a theory of the early days of geology, when the destructive influence of chemical processes in strata upon the remains of organisms in them was hardly admitted.

The great value of such researches as those so ably carried out by Thomson, Carpenter, and Jeffreys, is the definite knowledge they impart to the geologist who is theorising in the right direction, but whose notions of the depths at which the sediments containing Invertebrata can be deposited, are indefinite. The researches contribute to more exact knowledge, and they will materially assist the development of those hypotheses which are current amongst advanced geologists into fixed theories. I do not think that any geological theory worthy of the term, and which has originated from geological induction, will be upset by these careful investigations into the bathymetrical distribution of life and temperature. Physicists have propounded theories which have been accepted by some geologists; but they are looked upon as doubtful hypotheses by others. Palæontologists and such theories have constantly been at issue. The theories involving pressure and the intensity of the hardness of deep-sea deposits will suffer from the researches; but many difficulties in the way of the palæontologist will be removed. The researches explain the occurrence of a magnificent deep-coral fauna in the Palæozoic times in high latitudes, and of Jurassic and Cainozoic faunas on the same area, and they tend more than ever to the doctrines of uniformity. They explain the cosmopolitan nature of many organisms, past and present, which were credited with a deep-sea habitat, and they afford the foundations for a theory upon the world-wide distribution of many forms during every geological formation. It is not advisable, however, to make too much of the interesting identities and resemblances of some of the deep-sea and abyssal forms with those of such periods as the Cretaceous, for instance. In the early days of geological science there was a favourite theory that at the expiration of a period the whole of the life of the globe was destroyed, and that at the commencement of the succeeding, a new creation took place. There were as many destructions and creations as periods, or, to use the words of an American geologist, there was a succession of platforms. This theory held back the science, just as the theory that the sun revolved round the earth retarded the progress of astronomy. Moreover, it had that armour of sanctity to protect it which is so hard to pierce by the most reasonable opposition. Nevertheless every now and then a geologist recognised the same fossils in rocks which belonged to different periods. A magnificent essay by Edward Forbes on the Cretaceous Fossils of Southern India, a wonderful production and far before its age,* gave hope and confidence to the few palæontologists who began to assert that periods were perfectly artificial notions; that it did not follow because one set of deposits was forming in one part of the world, others exactly corresponding to it elsewhere, so far as the organic remains are concerned, were contemporaneous; and that life had progressed on the globe continuously and without a break from the dawn of it to the present time. The persistence of some species through great vertical ranges of strata, and the relation between the world-wide distribution of forms and this persistence, were noticed by d'Archiac, de Verneuil, Forbes, and others. The identity of some species in the remote natural-history provinces of the existing state of things, was established in spite of the dogmatic opposition of authorities; and these geologists accepted the theories that there were several natural-history provinces during every artificial period; that some species lived longer and wandered more than others; and that some have lasted even from the Palæozoic age to the present. Persistence of type was the title of a lecture delivered by Professor Huxley† many years ago; and this persistence has been admitted by every palæontologist who has had the opportunity of examining large series of fossils from every formation from all parts of the world.

Geological ages are characterised by a number of organisms which are not found in others, and by the grouping of numerous species which are allied to those of preceding and succeeding times, but which are not identical. Certain portions of the world's surface were tenanted by particular groups of forms during every geological age, and there was a similarity of arrangement in this grouping under the same external physical conditions. To use Huxley's term, the "homotaxis" of certain natural history provinces during the successive geological ages has been very exact. The species differed, but there was a philosophy in the consecutive arrangements of high-land and low-land faunas and floras, and of those of shallow seas, deep seas, oceans, and reef-areas. The oceanic * conditions, for instance, can be traced by organic remains from the Laurentian to the present time, and the deep-sea corals now under consideration are representative of those of older deep seas. The species which are new, and the varieties of those which have been already noticed, will be described and drawn in other communications. It is not a matter for surprise, then, that there being such a thing as persistence of type and of species, some very old forms should have lived on through the ages whilst their surroundings were changed over and over again. But this persistence does not indicate that there have not been sufficient physical and biological changes during its lasting to alter the face of all things enough to give geologists the right of asserting the constant succession of periods. The occurrence of early Cainozoic Madreporaria in the deep sea to the north-west of Great Britain only proves that certain forms of life have persisted during the vast changes in the physical geography of the world which were initiated by the upheaval of the Alps, the Himalayas, and large masses of the Andes. To say that we are therefore still in the Cainozoic age would hardly be consistent with the necessary terminology of geological science.

During the end of the Miocene age, and the whole of the Pliocene, the Sicilian area was occupied by a deep sea. The distinction between the faunas of those times and the present becomes less, year after year, as science progresses; and it is evident that a great number of existing species of nearly every class flourished before the occurrence of the great changes in physical geology which have become the artificial breaks of classificatory geologists. That the Cainozoic deep-sea corals should resemble, and in some instances should be identical in species with, the forms now inhabiting vast depths, is therefore quite according to the philosophy of modern geology. Before the deposition of the Cainozoic strata, and whilst the deep-sea deposits of the Eocene age were collecting in the Franco-British area, there was a Madreporarian fauna there which was singularly like unto that which followed it, both as regards the shape of the forms and their genera. Still earlier, during the slow subsidence of the great Upper Cretaceous deep-sea area, there was a coral fauna in the north and west of Europe, of which the existing is very representative. The simple forms predominate in both faunas. *Caryophyllia* is a dominant genus in either, and a branching *Synhelia* of the old fauna is replaced in the present state of things by a branching *Lophohelia*. The similarity of deep-sea coral faunas might be carried still further back in the world's history; but it must be enough for my purpose to assert the representative character and the homotaxis of the Upper Cretaceous, the Tertiary, and the existing deep-sea coral faunas. This character is enhanced by the persistence of types; but still the representative faunas are separable by vast intervals of time.

P. M. DUNCAN

* Trans. Geol. Soc.
† Royal Institution. See also Pres. Address, Geol. Soc.

* P. M. Duncan, Quart. Journ. Geol. Soc. No. 101.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, March 31.—"On the relation between sun's altitude and the chemical intensity of total daylight in a cloudless sky." By Henry E. Roscoe, F.R.S., and T. E. Thorpe, Ph.D. In this communication the authors give the results of a series of determinations of the chemical intensity of total daylight made in the autumn of 1867 on the flat tableland on the southern side of the Tagus, about 8½ miles to the south-east of Lisbon, under a cloudless sky, with the object of ascertaining the relation existing between the solar altitude and the chemical intensity. The method of measurement adopted was that described in a previous communication to the Society,† founded upon the exact estimation of the tint which standard sensitive paper assumes when exposed for a given time to the action of daylight. The experiments were made as follows:—1. The chemical action of total daylight was observed in the ordinary manner. 2. The chemical action of the diffused daylight was then observed by throwing on to the exposed paper the shadow of a small blackened brass ball, placed at such a distance that its apparent diameter, seen from the position of the paper, was slightly larger than that of the sun's disk. 3. Observation No. 1 was repeated. 4. Observation No. 2 was repeated.

† Roscoe, Bakerian Lecture, 1865.

The means of observations 1 and 3 and of 2 and 4 were then taken. The sun's altitude was determined by a sextant and artificial horizon, immediately before and immediately after the observations of chemical intensity, the altitude at the time of observation being ascertained by interpolation.

It was first shown that an accidental variation in the position of the brass ball within limits of distance from the paper, varying from 140 millimetres to 230 millimetres, was without any appreciable effect on the results. One of the 134 sets of observations was made as nearly as possible every hour, and they thus naturally fall into seven groups, viz. :—

(1) Six hours from noon, (2) five hours from noon, (3) four hours from noon, (4) three hours from noon, (5) two hours from noon, (6) one hour from noon, (7) noon.

Each of the first six of these groups contain two separate sets of observations, (1) those made before noon, (2) those made after noon. It has already been pointed out,* from experiments made at Kew, that the mean chemical intensity of total daylight for hours equidistant from noon is constant. The results of the present series of experiments proves that this conclusion holds good generally, and a Table is given showing the close approximation of the numbers obtained at hours equidistant from noon.

Curves are given showing the daily march of chemical intensity at Lisbon in August, compared with that at Kew for the preceding August, and at Parà for the preceding April. The value of the mean chemical intensity at Kew is represented by the number 94·5, that at Lisbon by 110, and that at Parà by 313·3, light of the intensity 1·0 acting for 24 hours being taken as 1,000.

The following Table gives the results of the observations arranged according to the sun's altitude :—

No. of Observations.	Mean Altitude. ° ′	Chemical Intensity. Sun.	Sky.	Total.
15	9 51	0·000	0·038	0·038
18	19 41	0·023	0·063	0·085
22	31 14	0·052	0·100	0·152
22	42 13	0·100	0·115	0·215
19	53 09	0·136	0·126	0·262
24	61 08	0·195	0·132	0·327
11	64 14	0·221	0·138	0·359

Curves are given showing the relation between the direct sunlight (column 3) and diffuse daylight (column 4) in terms of the altitude. The curve of direct sunlight cuts the base line at 10°, showing that the conclusion formerly arrived at by one of the authors is correct, and that at altitudes below 10° the direct sunlight is robbed of almost all its chemically active rays. The relation between the total chemical intensity and the solar altitude is shown to be represented graphically by a straight line for altitudes above 10°, the position of the experimentally determined points lying closely on to the straight line.

A similar relation has already† been shown to exist (by a far less complete series of experiments than the present) for Kew, Heidelberg, and Parà; so that although the chemical intensity for the same altitude at different places and at different times of the year varies according to the varying transparency of the atmosphere, yet the relation at the same place between altitude and intensity is always represented by a straight line. This variation in the direction of the straight line is due to the opalescence of the atmosphere; and the authors show that, for equal altitudes, the higher intensity is always found where the mean temperature of the air is greater, as in summer, when observations at the same place at different seasons are compared, or as the equator is approached when the actions at different places are examined. The differences in the observed actions for equal altitudes, which may amount to more than 100 per cent. at different places, and to nearly as much at the same place at different times of the year, serve as exact measurements of the transparency of the atmosphere.

The authors conclude by calling attention to the close agreement between the curve of daily intensity obtained by the above-mentioned method at Lisbon, and that calculated for Naples by a totally different method.

"On the acids contained in crab oil." By William J. Wonfor, Student in the Laboratory of the Government School of Science, Dublin. Communicated by Dr. Maxwell Simpson.

* Phil. Trans. 1867, p. 558.
† Phil. Trans. 1867, p. 555.

Crab-oil is obtained from the nuts of a tree named by botanists *Hylocarpus carapa* and also *Carapa Guianensis*. The tree grows abundantly in the forests of British Guiana; the oil is prepared by the Indians, who bring it to George Town for sale. The oil is obtained from the kernels by boiling them for some time, and then placing them in heaps and leaving them for some days; they are then skinned, and afterwards triturated in wooden mortars until reduced to a paste, which is spread on inclined boards and exposed to the sun; the oil is thus melted out, and trickles into receiving vessels.

As no investigation, so far as I have been able to ascertain, has ever been made of the acids contained in this oil, Professor Galloway, to whom I am indebted for the samples of the oil, recommended me to examine them, and the examination was conducted under his direction. The acid, when pure, presents the appearance of a white glistening radiated crystalline mass. The percentage composition obtained was as follows :—

Carbon	74·856
Hydrogen	12·570
Oxygen	12·574
	100·000

These analyses agree very closely with the formula for palmitic acid, $C_{16}H_{32}O_4$.

Royal Geographical Society, March 28.—The president, Sir R. Murchison, in the chair. A paper was read by Sir Charles Nicholson, Bart., on Forrest's Journey in Western Australia; Goyder's survey of the neighbourhood of Port Darwin, and on the recent progress of discovery in Western Australia, and remarks on Papua or New Guinea. Intense interest had been felt in the fate of Leichhardt and his party, who were last heard of in 1849 S.W. of the Gulf Carpentaria; a report was brought to the government of Swan River, of the existence of the remains of two white men and horses in the unexplored region N.E. of the colony. An expedition was fitted out, under Mr. Forrest, with whom Mr. Monger and Mr. M. Hamersley were associated, and the native Jimmy Mungaro acted as guide. The place indicated was Koolanobbing, lat. 30° 53′ S., and long. 109° 14′ E. The expedition was exceedingly well managed, and the country was thoroughly examined. They left Newcastle April 19, 1869; passed through a sandy country without grass; water was scarce; salt lakes nearly dried up were met with; from the limit of Gregory's exploration, 118 long., they travelled north; found granite hills, with spearwood and acacias; in May 5 they reached Lake Moore, and learned that the remains were those of horses which had been poisoned, having strayed from an out station; some unfriendly natives, who threatened to kill and eat the white men, were met with; several large dry salt lakes were discovered, one of which, named Lake Barlee, was conjectured to be 80 miles in length, the farthest point, 28° lat. 41′ S., and 122° 50′ E. long., was reached July 2nd. The country throughout of the same barren worthless character, granite hills, no grass, and scanty supplies of water. The return journey was made to north of Lake Barlee, westward to Bunnaroo, and southward to Mount Singleton on July 23rd; the result was that no traces of Leichhardt were found, and the country explored was pronounced unfit for either pasture or agriculture. In the sea board districts and about Mount Singleton there was excellent land, all Western Australia wanted was population. Sir Charles Nicholson then proceeded to notice the recent survey of Port Darwin, in North Australia, which region, between 128° and 138° E. long., and north of 26° S. lat., had been most unreasonably annexed to South Australia. The South Australian attempt to open communication through the interior, and found a colony at Port Essington, had failed, and the colony had been abandoned. Port Darwin lies to west of Adelaide River, on northern coast, opposite Melville Island; it possesses a good harbour, a million acres of good land have been surveyed, fit for horses and cattle, not for sheep, climate from May to September is good, then moist and hot; intercourse by sea between the Malays of Macassar and this port exists. Port Darwin has been recommended as a port for shipping horses for the Indian market, the central region is impracticable, but the route followed by M'Kinlay from Northern Queensland is, in the opinion of Mr. Goyder, Colonial surveyor, the best; this, Sir Charles Nicholson thought showed that North Australia ought to form part of Queensland. Sir Charles gave a rapid *résumé* of the progress of discovery in Australia from Captain Cook's voyage, and the foundation of Port Jackson in 1788; the labours and journeys of Dr. Bass, Sturt, Mitchell, Eyre, &c., were glanced at. Dr. Leichhardt was absent two years on his first expedition to Port Essington, and was given up for lost, a monument, with an epitaph composed by a friend, having been erected to him. In conclusion a hope was expressed that geographical discovery would be still prosecuted, especially with reference to the magnificent but almost unknown Papua or New Guinea, the position, fauna, and flora of which constitute it a natural appendage to Australia, a line of small islands connecting it with our settlement at Cape York. Captain Blackwood in H.M.S. *Fly*, in 1845, examined 140 miles of coast, lat. S. 8° 45', long. E. 143° 35', to 7° 40' lat. 144° 30' long., containing the delta of a large river. In the south-eastern peninsula, mountains 11,000 ft. to 13,000 ft. high, were observed by Captain Stanley, these were in sight for several days coasting, with richly wooded slopes. The Government survey vessel at Cape York might be used for exploration of this country. The natives were hostile, and had the reputation of being fierce and warlike. The president said that he had urged on the Government the impolicy of uniting North and South Australia, and the necessity of forming a port of refuge, and a naval station at Port Darwin. He alluded to Mr. Crawford's estimate of the Papuan climate as most unhealthy. General Lefroy reminded the meeting of the omitted name of his brother, a successful explorer of Western Australia. The question of the suitability of Port Darwin as a depôt for the horses to be sent to India was discussed. The project had been favourably reported on to Lord Mayo by Sir James Ferguson, the North-eastern or Flinders river route being preferred. With regard to the climate, Mr. Findlay mentioned the excellence of the Timor ponies. Mr. Saunders pointed out that the navigation would be much safer if a port were selected in the Gulf of Carpentaria.

Chemical Society, March 30.—Anniversary meeting, Prof. Williamson, F.R.S., President, in the chair. The following officers have been elected for the ensuing year:—President, Dr. A. W. Williamson; Vice-presidents who have filled the office of president, Sir B. C. Brodie, Warren De la Rue, A. W. Hofmann, Dr. W. A. Miller, Dr. Lyon Playfair, Col. P. Yorke; Vice-presidents, Dr. J. H. Gilbert, Dr. E. Frankland, Dr. A. Matthiessen, Dr. H. M. Noad, Prof. W. Odling, Dr. T. Redwood; Secretaries, A. Vernon Harcourt, W. H. Perkin; Foreign Secretary, Dr. H. Müller; Treasurer, F. A. Abel; ordinary members of the Council, Dr. E. Atkinson, H. Bassett, E. T. Chapman, F. Field, David Forbes, Dr. M. Holzmann, Dr. E. J. Mills, Dr. W. J. Russell, Dr. Maxwell Simpson, Dr. R. Angus Smith, Dr. John Tyndall, Dr. A. Voelcker. After communication of the above list the president delivered the following address:—"Gentlemen,—On behalf of the council I feel very great pleasure in congratulating you on the rapidly increasing usefulness and prosperity of our Society. The most interesting incident in the history of the past year has been the delivery by M. Dumas of the inaugural Faraday lecture. It was indeed an impressive tribute to the memory of our great countryman which was paid by that noble veteran of science, and one of which the record ought to occupy a place of honour in our journal. We still hope to receive from M. Dumas a manuscript of his classical discourse. The council have had the pleasure of accepting the offer of a munificent donation of Palladium from Messrs. Johnstone and Matthey to be used for the preparation of the ten first Faraday medals. Your council have felt it to be of considerable importance to give greater publicity to the proceedings of the society, and they have accordingly made provisional arrangements for the preparation of abstracts of the papers, and in some cases of the discussions, for transmission to such papers as desire to publish them. These abstracts already appear in several papers and are read with interest. Another matter of considerable importance has been brought under the notice of your council, and has been by them referred to the careful consideration of a sub-committee who will report to the new council. The great activity of chemists in France and Germany leads to the publication of vast quantities of important matter in languages not easily intelligible to many of our members, and a feeling has been entertained for some time past that the progress of our science and of its applications would be greatly promoted by the regular publication in the English language of accurate reports of all chemical papers. For many years past annual reports of this kind have been published in Germany, first under the auspices of the great Berzelius, and latterly under those of Liebig and Kopp. The French Chemical Society has also added very greatly to the value of their journal by publishing in it reports of a great number of important papers from various sources, and I am happy to say that the eminent chemists who are at the head of that society concur with us in desiring to publish reports combining the completeness of the "Jahresberichte" with a much greater celerity of appearance, so that our respective members may have presented to them every month an outline of all that has been done in the science since the last report. It appears that considerable facilities would be afforded for the preparation of such reports by a joint action of the two societies, and our friends in Paris have expressed the utmost readiness to co-operate with us in this important matter. I hope at our next anniversary meeting to be able to congratulate the society on the commencement of a system of international working."

The president proceeded by giving the present number of fellows, of the foreign members, the list of the deceased, and concluded with a commemorative speech on Thomas Graham. The greater part of this speech is to be found in the biographical sketch in the first number of NATURE. The following additional remarks, however, are worthy to be quoted here. "In 1837 Graham was appointed to the chair of chemistry in the newly-founded London University, now called University College, London. It was here that the young philosopher found adequate scope for his abilities. Young men, thirsting for knowledge, crowded to his lectures, and in those lectures he explained the principles of chemical science with an exactness and clearness never before attained. The success of these lectures was not due to eloquence, nor to any smoothness of diction, for all such matters Graham usually neglected to a degree which in an ordinary person would hardly have been excused. He had a truly philosophical method which carried away the listener with irresistible force. The same exactness of thought, the same logical arrangement of matter, in a word, the same purely scientific mind pervades his work, the 'Elements of Chemistry,' a work which is too well-known to chemists all over the world, for it to be necessary to speak here of its great merits." After having sketched the outlines of the most important of Graham's investigations, the president alluded in the following manner to Graham's activity as Master of the Mint:—"He remained at University College till the year 1855, when he was appointed Master of the Mint, an office which Sir John Herschel had recently resigned. His illustrious friend Hofmann, from whom I have already freely quoted, shall tell how he discharged these responsible duties. 'It would be difficult to picture the extensive activity which Graham exercised in the high office entrusted to him. The new master of the mint showed a circumspection, a mastery of details, an amount of industry and energy, and, when occasion required, an impartial severity, which astonished every one, more especially some of the officials of the mint. Such requirements had not hitherto been made, nor such control exercised. A strong resistance was made to the plans of innovation and alteration of the new master.' The author of these lines, Hofmann, at that time held an office in connection with the Mint, and was therefore witness of Graham's struggles in his new position. It was years before he gained a complete victory, and before he was able to return to his favourite study. But at last this longed-for period came, and a series of happy years followed. Not an instant was lost. A convenient laboratory was fitted up in the official residence of the Master of the Mint, whose handsome rooms the simple and independent man never occupied, and there his old labours were resumed with greater zeal than ever. Some of Graham's most beautiful researches date from this period. They sprang from the pure love of science. Graham needed to earn no name or position. Both had long been his undisputed property. But the same earnest desire to study nature, which in early youth had induced him to bear without murmurs the greatest privations and the bitterest sorrows, still animated him and armed him against the new dangers which threatened his scientific labours from the splendour of his official position and the distractions which it entailed on him." The proceedings of the meeting terminated with a vote of thanks to the president for the able and effective manner in which he had discharged his official duties during the past year.

Geological Society, March 23.—Warington W. Smyth, F.R.S., Vice-President, in the chair. Mr. F. A. Potter, B.Sc., Assoc. Royal School of Mines, Cromford, Derbyshire, was elected a Fellow of the Society. The following communications were read:—Professor Huxley communicated a letter received by him from Dr. Emanuel Bunzel, of Vienna, giving a short account, illustrated with figures, of the posterior portion of a skull obtained by Professor Suess from a coalmine of Upper Cretaceous (Gosau) age. Dr. Bunzel stated that at the first glance this skull appeared to possess Reptilian characters, but that the convexity of the occiput, and its gentle passage into the roof of the skull, the presence of a transverse ridge in the occipital region, the absence of sutures, the globular form of the condyle, and some other peculiarities, prevent the animal to which this skull belonged from being referred to any known order of reptiles. The author compared this fragment of a skull with that of a bird, and suggested the establishment of a new order of fossil Reptiles (*Ornithocephala*), closely related to Prof. Huxley's *Ornithoscelida*. He proposed to refer his fossil to a new genus, which he named *Struthiosaurus*.

"On the discovery of organic remains in the Caribean Series of Trinidad." By Mr. R. J. Lechmere Guppy, F.L.S., F.G.S. The author described the rocks of the "Caribean group" as consisting of gneiss, gneissose, talcose, and micaceous slates and crystalline and compact limestones, and remarked upon the probable distribution of rocks of the same series on the continent of South America. In Trinidad the uppermost member of the series is a compact dark blue limestone, which contains obscure, but very abundant fossils; in the subjacent clay-slates and quartz rocks calcareous strings and bands containing more distinct traces of organisms occur. The author believed that he had detected an *Eozoon* (which he called *E. caribeum*), a *Favosites* (named *F. fenestralis*), a coral, and fragments of echinoderms. He considered it probable that the Caribean series was pre-silurian. Dr. Carpenter, from the slight examination he had been able to make of the fossils, was unwilling to speak decidedly about them. There was, however, no doubt of numerous organic remains occurring in the rocks, and among them serpuline shells and echinoderms. As to the supposed *Eozoon*, he had not been able to recognise any of the characteristics of that fossil; and by treating the Trinidad specimens with acid, he found no traces of structure left, and yet there had not been sufficient metamorphism to destroy other organisms. In some dredgings from the Ægean Sea he had found fragments of echinoderms and other organisms, in which a siliceous deposit had replaced the original sarcode in the same manner as had occurred in the Canadian *Eozoon*, thus proving the possibility of this form of substitution, which had been warmly contested. Mr. Tate offered some suggestions as to the age of these beds, which were certainly older than Neocomian. The Californian gold-bearing beds appear to be Jurassic. Similar beds occurred in New Mexico, Guatemala, and were observed by him in Nicaragua and Costa Rica. These present lithological and mineralogical affinities to the Venezuelan and Trinitation metamorphic series, and were conjectured to be of the same age.

"On the Palæontology of the Junction-beds of the Lower and Middle Lias in Gloucestershire." By Mr. R. Tate, A.L.S., F.G.S. The object of this paper was to show that the attachment of the zone of *Ammonites raricostatus* to the lower lias and that of *A. Jamesoni* to the middle lias harmonises with the distribution of the organic remains: 50 species were catalogued from the united zones of *A. oxynotus* and *A. raricostatus*, 8 of which pass up into the middle lias, whilst 13 occur in the lower horizons; 115 species were enumerated as occurring in the zone of *Ammonites Jamesoni*, 60 of which pass to higher zones, whilst 11 made their first appearance in the lower lias; the number of species common to the contiguous zones being 14. The author inferred that, as the conditions of depth and deposit of the upper part of the lower lias are repeated in the lower part of the middle lias, accompanied by a total change in the fauna, a break in the stratigraphical succession existed between the lower and middle lias. This view is supported by the fact of the numerical decrease of species in passing up through the several stages of the lower lias, and that of the introduction of many new generic types with the zone of *Ammonites Jamesoni*. Many new species were described. Prof. Boyd Dawkins had attempted to test these liassic zones as a means of classification of the rocks in Somersetshire, and the result had been that he had been unable to accept them as fixing hard and fast lines of demarcation; for he had found three of the distinctive Ammonites together in one bed. On our present shores the change of one form of molluscan life for another seemed to take place in limited areas, and to be dependent on some slight variation of physical conditions rather than on any great change. He had not been able to trace any stratigraphical unconformity between the middle and lower lias in many parts of England, whatever might be the case in Gloucestershire. Mr. Tate, in reply, gave an account of the manner in which he had arrived at his conclusions, and expressed his assent to the view that ammonite-zones were only of value over limited areas, but considered that a triple division in the lower and a dual division in the middle lias were well established on palæontological and lithological features. The break which he had pointed out was palæontological rather than stratigraphical, though the one might be inferred from the other.

"Geological Observations on the Waipara River, New Zealand." By Mr. T. H. Cockburn Hood, F.R.S. In this paper the author described the general features of the locality from which he has obtained bones of *Plesiosaurus*, *Ichthyosaurus*, and *Teleosaurus*. The bones were not obtained *in situ*, but from large boulders and blocks scattered in the ravines of the Waipara and its tributaries. Professor Boyd Dawkins remarked on the presence of Crocodilia in New Zealand being proved by the procelian vertebra.

Mr. R. H. Scott, F.G.S., communicated an extract from a letter addressed to him by M. Coumbary, Director of the Imperial Observatory of Constantinople, containing an account received from M. L. Carabello of the reported fall of a large meteorite near Mourzouk, in the district of Fezzan, in lat. 26° N., and long. 12° E. of Paris. It fell on the evening of the 25th December last, in the form of a great globe of fire, measuring nearly a metre in diameter; on touching the earth it threw off strong sparks with a noise like the report of a pistol, and exhaled a peculiar odour. It fell near a group of Arabs, who were so much frightened by it that they "immediately discharged their guns at this incomprehensible monster."

PARIS

Academy of Sciences, April 4.—The following mathematical papers were read:—Description, with plans, of an instrument, by which spherical triangles may be solved without the aid of tables of logarithms, by M. Blanqui; On the fundamental points of two surfaces, of which the points correspond one by one, by M. H. G. Zeuthen; on the theory of equations with partial derivatives, by M. G. Darboux (second memoir); and On a mode of approximation of the functions of several variables, by M. Didon.—M. de Saint-Venant presented a memoir on a second approximation in the rational calculation of the pressure exerted against a wall of which the posterior surface has a certain inclination, by incoherent soil rising in a talus from the top of this surface of the wall; and M. Boussinesq an integration of the differential equation which may furnish a second approximation in the calculation of the same pressure.—M. Jamin communicated a note on the latent heat of ice, and presented a note by MM. Wecker and Robin on an objective with prisms, to be used in an ophthalmoscope which will enable two persons to observe the eye at the same time.—M. Phillips presented a memoir by M. Martin de Brettes on an apparatus for the demonstration of the phenenomena of the trajectory of oblong projectiles driven by rifled guns.—M. Delaunay communicated an extract from a letter from M. G. Oltramare on the existence of a law of repartition, analogous to Bode's law, for each of the systems of satellites of Jupiter, Saturn, and Uranus; and a note by M. R. Wolf on the frequency of the sun's spots, and its relation to the variation of magnetic declination. The author gave a table of his observations of solar spots during the years 1864–1869, showing a minimum in 1867, in conformity with his period of $11\frac{1}{9}$ years. He also applied his formula for the calculation of the magnetic variation in relation to the solar spots, to the results of observation at the Observatory of Christiania, and cited the data of several years to show at all events a close approximation.—A paper was read by M. Chapelas on the centres of mean position of shooting stars, which is the name he gives to the points from which the groups of meteors seem to issue.—M. C. Viollette presented a paper on the existence of selenium in commercial copper. The author stated that by oxydising copper in a muffle-furnace and then heating the oxide to redness for several hours in a current of dry pure air, crystals of selenious acid are obtained. The copper operated upon by lime was probably from Chili; he proposes to examine other coppers, and requests manufacturers to forward to him, at the Faculty of Sciences of Lille, specimens of copper of known origin. M. Viollette also presented a note on the cause of the acidity of the water of organic analyses, which he ascribes to the presence of selenious acid in the oxide of copper employed in the combustion tubes.—M. E. Royer read a paper on the reduction of carbonic acid into formic acid. The author, having found that formic acid is produced by the reduction tof oxalic acid in the porous vessel of a Bunsen's battery in presence of hydrogen, has subjected carbonic acid to the same treatment, and found that this also furnishes formic acid.—M. Mauméné forwarded a further note on his general theory of chemical action; and M. Dubrunfaut a paper on the law of dilatation of gases.—M. Guyon communicated some remarks on a paper by M. Ramon de la Sagra, describing an anomalously branched structure in the stem of a palm-tree (*Oredaxa regia*). M. Guyon stated that a similar anomaly is very common in the date palm. —In a note presented by M. de Quatrefages, on the inversion of the viscera and its artificial production, by M. C. Dareste, the author stated that he had produced this condition in young chicks, by maintaining a temperature at the heating point of 105·8°—107·6° F., whilst the surrounding temperature was allowed to oscillate from 21° to 28°.—M. Bouley communicated an important report on the results of the inquiry instituted by the Ministry of Agriculture into the occurrence of hydrophobia in France during the years 1863-1868. From his statements, which unfortunately rest on rather imperfect documents, it appears that a large number of persons bitten by dogs supposed to be rabid, escape all serious consequences of the bites; that the summer is not more dangerous than any other season; and that immediate cauterisation of the bite appears to be the only sure remedy.—M. H. Sainte-Claire Deville presented a note by M. Piarron de Montdésir on ventilation by means of compressed air, accompanied by a purification and cooling of the new air, and a disinfection of the vitiated air. The author proposed to employ strong jets of compressed air, which would carry with them a considerable body of uncompressed air; the cooling and purification of this air from dust is to be effected by means of a small jet of water in the midst of each air-jet; and the purification of the vitiated air by substituting a disinfecting liquid for the water in the jets of compressed air in action at the bottom of the ventilating flues. With regard to M. Wœstyn's recent proposal to purify the vitiated air of hospitals, &c., by burning it, which is rejected on the score of expense by the author, M. Montanier remarked that in 1864 he had suggested a similar plan.—MM. Mille and Durand Claye presented a memoir giving the results of the experiments made for the utilisation of the sewage waters flowing into the Seine, which they propose to divert entirely from their direct influx into the river, and to apply as manure to the neighbouring country.

VIENNA

Imperial Academy of Sciences, February 17.—The president noticed the decease of Dr. Franz Unger, the well-known botanist and vegetable palæontologist, on the 13th Feb.—The following papers were read:—1. On the observation of oscillations by Prof. E. Mach of Prague. He stated that a very simple and effective form of vibroscope is obtained by placing a row of König's burners along one side of an organ pipe, and described some of the effects observable by means of this instrument.—2. On the intestinal movements, by Dr. S. Mayer, containing the results of a series of experiments, relating especially to the innervation of the intestines, which had been made by him in conjunction with Dr. S. von Basch.—3. Dr. Boué completed his address on the petrographic and geognostic results of his travels in European Turkey.—The reports of observations at the Central Institution for meteorology and terrestrial magnetism during the month of January, were communicated.

March 10.—The president announced the death of Professor Joseph Redtenbacher on the 5th March. The following papers were read:—1. On the renal pelvis of the mammalia and of man, by Professor Hyrtl, in which the author described in detail the structure of the urine-secreting organs in a great number of mammals.—2. Phanological studies, by M. Karl Fritsch, containing the results of observations made in Austria and Hungary on the blooming and maturity of plants, and on the first and last appearances of periodically occurring animals.—3. On the after-pictures of excitant changes, by M. V. Dvorák, showing that the after-pictures of movements observed by Plateau and Oppel are not isolated phenomena, but that similar effects are produced by changes of brightness.—4. On the rational triangle by M. H. Rath.—5. On the simple construction of obliquely turned hyperboloids and paraboloids by Professor R. Niemtschik.—6. On a cosmical attraction exerted by the sun through its rays, by M. C. Puschl, in which the author sought to prove that by means of the æther-waves issuing from it the sun exerts an attraction upon opaque bodies, equivalent to the repulsion which it must have produced, according to the hypothesis of emanation, by the material particles emitted by it.—7. On the atomic heat of oxygen in its solid compounds, by M. J. Tollinger. —8. On the action of *Digitalis* and *Tinct. Veratri viridis* upon the temperature in crupose pneumonia, by Dr. L. von Schrötten.—9. Prof. V. von Lang delivered an address upon a new method of investigating the diffusion of gases through porous septa. His apparatus consists of a porous cell united by a thin caoutchouc tube with the air-tube of a Mariotte's bottle, so arranged that the gas in the cell is always under the atmospheric pressure, and as soon as an increase of volume takes place in it the excess flows over into the bottle, displacing an equivalent amount of water, which is determined by weighing.—10. The second part of investigations on ammonites by Prof. Suess, in which the author treated chiefly of the structure of the shell in the Cephalopodous mollusca. He showed that the shell which exists in the females of the existing genus *Argonauta*, is to be regarded as a rudimentary ammonite shell, consisting of an ostracum or outer layer without a nacreous layer, and that *Argonauta* belongs to a great group, commencing with *Trachiceras* and including *Cosmoceras, Toxoceras, Crioceras*, many *Scaphites*, and the *Flexuosi*.

DIARY

THURSDAY, APRIL 14.

MATHEMATICAL SOCIETY, at 8.—On the Mechanical Description of a Nodal Bicircular Quartic: Prof. Cayley.

MONDAY, APRIL 18.

ROYAL ASIATIC SOCIETY, at 3.

TUESDAY, APRIL 19.

ANTHROPOLOGICAL SOCIETY, at 8.—On the Hypothesis of Pangenesis applied to the Faculty of Memory: Mr. Alfred Saunders.—Note on Consanguineous marriages: Mr. G. C. Thompson.

WEDNESDAY, APRIL 20.

METEOROLOGICAL SOCIETY, at 7.
SOCIETY OF ARTS, at 8.

THURSDAY, APRIL 21.

LINNEAN SOCIETY, at 8.—On the Vertebrate Skeleton: Mr. St. George J. Mivart.
CHEMICAL SOCIETY, at 8.

BOOKS RECEIVED

ENGLISH.—Forms of Animal Life: Prof. Rolleston (Clarendon Press).—Manual of Zoology: Dr. Nicholson (Hardwicke).—Alpine Flowers for English Gardens: W. Robinson (Murray).

FOREIGN.—Ueber Gährung und die Quelle der Muskelkraft, und Ernährung: Liebig.—Through Williams and Norgate.

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ERRATA.—In No. 23, page 580, second column, line 1: for "Langel," read "Laugel;" for "Lartel," read "Lactet."—Line 3: for "carnulorum," read "carnutorum."—Line 4: for "Trojonotherium," read "Trogontherium."