THURSDAY, DECEMBER 18, 1884

A TEACHING UNIVERSITY FOR LONDON

A MOVEMENT, which first began to shape itself into form at the Educational Conference at the Health Exhibition, made its first formal public appearance at the house of the Society of Arts on Monday afternoon. The crowd of well-known and much-occupied men with which the room was filled was at least an earnest of something more than a discussion of a mere speculative project; and the speeches made, though revealing, as might be expected, a considerable diversity in point of view, were listened to with a closeness of attention which indicated a pretty confident belief that the movement was not likely to evaporate in mere debate.

Lord Reay opened the proceedings with an address, which was admirably conceived both in tone and matter. If subsequent speakers scarcely can have been said to have carried on the discussion on the same level, this may be attributed to the fact that the report submitted to the meeting for adoption by Lord Justice Fry embodied an amount of detailed suggestion which the meeting was naturally not in any way prepared to assimilate without a good deal of consideration.

Every one knows that we have in London a body bearing the title of a University. Every one, at least who has looked into the matter, knows equally the immense services which this institution has rendered in raising the standard of middle class education. But a University all the same, in any intelligible sense, it is not. It is essentially nothing more than a Government Department for giving, after examination, academic certificates. Nor, as Professor Lankester very properly pointed out, is it, any more than the Home Office for example, an institution which, because its head-quarters happen to be in London, is locally identified with the metropolis in the same sense in which the Universities of Oxford and Cambridge are identified with the places in which their work is carried on. The operations of the University of London are, in point of fact, more wide-reaching than those of any other Government office, and are, indeed, co-extensive with the Empire itself.

In one aspect the whole movement may be regarded as an outcome of the nascent municipal feeling in the life of the metropolis. The Examining University, for reasons stated above, does not, and in its present form never can, satisfy the reasonable desire that the metropolis should possess that academic crown which is worn by every other great capital in the world. The disembodied spirit of what might be brooding over gloomy examination halls may strike a wholesome terror into the hearts of candidates, and sustain a certain feeling of emancipation in the hearts of candidates; but it cannot, and does not, excite any enthusiasm in either. Nor has the cold officialism of Burlington Gardens ever treated with more than a lofty disdain the more humanly organised institutions which furnish the victims who pour into its portals.

The movement to constitute a Teaching University is undoubtedly in some degree due to a reaction against this state of things. Those whose business "is to teach, know now-a-days that a great deal depends on the way teaching is done. It is here that the educational bodies of the metropolis feel their isolation. There is no central authority to gather their representatives into its fold and smooth away the individual difficulties in the way of common action and "bringing into harmonious cooperation the dual business of examination and teaching. Life is getting appreciably shorter now; the thread of existence has more knots though its length remains the same. The time that can be given to education out of an ordinary existence cannot be indefinitely expanded. Method must be brought in to economise labour in instruction. This is a very different thing to cramming; it is on the contrary a scientific mode of directing the educational attack in the most effective way. Here the rulers of the University have shown themselves most deficient in sympathy; they have turned an obdurately deaf ear to the entreaties which have been repeatedly addressed to them by the Convocation of the University to get "touch" with the teaching bodies. And, what is perhaps even still more irritating, though, as remarked at the meeting, for the most part, laymen in education, they still issue in a purely *doctrinaire* spirit directions which of course from the nature of the case have the binding force of edicts at the actual seats of education. Dr. Carpenter, with an official optimism excusable enough in one who has devoted a lifetime to loyal and honest work, contended, it is true, that the university was blameless in this respect. But those who are familiar with the other side of the shield know how far this is from being the feeling in teaching institutions. Manchester has already broken away from the rule of Burlington Gardens, and it can scarcely be doubted that had the University of London shown a more conciliatory attitude with regard to the formation of Boards of Studies, the present movement would in all probability have taken a very different shape.

It is proposed, then, alongside of the existing examinations to have a Teaching University. This it is also intended should examine and grant degrees. It may be thought that this is going too far, and that it is not desirable that the one thing should become a mere mechanical reflection of the other. But the risk is small; the principle is now-a-days accepted by all who have really studied the matter, that teachings and examinings must be in the hands of the same persons; but this does not imply that the same individuals should control both. Nor, it must be admitted, is this merely a matter of interest to the teaching bodies. The imperfect educational discipline to which a large proportion of the candidates who frequent the examination rooms of the university have been subjected, leads to an inordinate amount of rejections. This creates the misconception in the public mind, that the examinations are unreasonably severe. The real fact is that the candidates are badly prepared. In this way the want of cooperation between teachers and examiners becomes indirectly a real obstacle to educational progress.

So far we have endeavoured to give our readers an account as distinct as we have been able to gather of the forces which have initiated this movement, and the aims which are desired by it. We cordially sympathize with both, and it is because we do so that we must now indulge in a little criticism on the scheme as put forward by Lord Reay's committee. In the first place, we found it difficult

to believe that the creation of a new university with full powers in the metropolis is ever likely to come within the bounds of political possibility. It is not that the Government will be inaccessible, but that it will be difficult to persuade general public opinion of the necessity of such a course. We believe that it will in the end be necessary eventually to come to terms with the existing university. The fact that eleven members of its Senate have joined the movement, shows that that body at any rate contains a powerful element discontented with its present asphyxiation by red tape. What, however, we do hope to see is the federation of our scattered educational bodies in London into Faculties, which would be practically universities in all but the name, and the representatives of which should have a leading voice in the management of the Central University. The only speakers who really evinced at the meeting a clear idea of their own policy, were the representatives of the Medical profession. Prof. Marshall showed with singular lucidity that the altered character of medical education has made the continued isolation of the smaller medical schools a practical impossibility. Not merely has technical instruction gone beyond the capacity of the junior members of the medical staff who are usually told off for it, but the appliances required are too costly for all but the wealthier schools to provide efficiently, and the teachers are themselves wanted for the more minute and careful clinical instruction which is now everywhere demanded.

The Medical Schools will therefore combine, perhaps, into some four great groups, for purposes of education and the organisation of laboratories, just as the small colleges at Oxford and Cambridge have combined for purposes of intra-collegiate lecturing. Once federation has begun, the foundation of a medical faculty for London is only a question of time. This will come about, probably, whatever the fate of the more general movement. But such a faculty would undoubtedly be found to be politically a body to whose just claims in direct medical education the University of London would find it impossible to lend a deaf ear.

The faculty of law may also shape itself into existence, though, it must be admitted, the elements of its form are, at present, very dim and shadowy.

To balance these we want a faculty of literature and science, and the materials for these are to be found in a federation of University and King's Colleges, as suggested by Prof. Lankester. If the representatives of such a faculty were allowed a proper share in the councils of the existing University, it is not obvious why such a federation should be intrusted with a separate degree-giving power.

We now come to what appears to us the weak point in the scheme. A university may impart knowledge; it may test its quality when imparted; but that which has ever been the peculiar glory of university life, is to enlarge its bounds. But except a few well-expressed sentences which fell from Lord Reay, and a sentence put into the conclusion of the report very much with the air of an afterthought, this very important matter does not seem to have received very much attention. Now the most melancholy feature about such elements of university organisation as already exist in London, is its displayed incapacity to retain its best men. There is an obvious dearth of such posts as would satisfy their legitimate ambition. No sooner amongst us does a man rise to the first rank at any seat of education, than sooner or later he is drafted off to one of the universities in the provinces. To take the first instances that come to hand: Cambridge has robbed us of Michael Foster, and Oxford of Burdon Sanderson, while the greatest biological teacher of the day is driven from England by ill-health after a life toilsomely spent in the lowest order of teaching—drudgery. What is absolutely essential to add lustre and distinction to the work of a Metropolitan University is a body of University Professors who would take charge of the higher studies, which never can be properly cared for by bodies sedulously occupied with the very serious business of the higher education. What we hope then some day to see is the University of London equipped with a proper staff of Regius Professors, who themselves would be at the least an invaluable bond of union between its own too abstract isolation and the living reality of the actual teaching bodies.

Although we could have wished for greater insistence on this—as it seems to us—most vital point, we cannot but entertain the highest hopes of the usefulness of the present movement. It has some of the notes of healthy organic development; it has at least spontaneity and individual activity, which have always been the foundations of political achievement amongst us. At the worst, mere effervescence is better than stagnation, and we think there is more in this movement than effervescence. In any case we cannot too warmly tender our expression of acknowledgment to public men like Lord Reay and Sir George Young, who have spared neither pains nor labour in the purely patriotic labour of giving our own too inarticulate murmurings definite form and expression.

THE POLYZOA OF THE "CHALLENGER" EXPEDITION

The Zoology of the Voyage of H.M.S. "Challenger." Part XXX. "Report on the Polyzoa—the Cheilostomata." By George Busk, F.R.S., V.P.L.S., &c. (Published by Order of Her Majesty's Government, 1884.)

THE description of the Polyzoa collected during the expedition of the *Challenger* was undertaken by Mr. Busk, and the first part of his Report, comprising the Cheilostomatous forms, or those in which the mouth of the zoœcium or cell is provided with a movable lid which shuts down over the polypide when retracted, has just been published.

The investigation of this important part of the *Challenger* collections could not have been placed in better hands. As an authority on the zoology of the Polyzoa, Mr. Busk stands pre-eminent; and the present admirable Report of 216 pages and 36 plates bears testimony to a laborious and conscientious investigation, the value of which as a contribution to our knowledge of the multitude of forms associated under the name of Polyzoa cannot be over-estimated.

The number of species of Cheilostomatous Polyzoa in the *Challenger* collection is 286, and when these came into Mr. Busk's hands he found no less than 180 of them

new. In one genus alone, that of the *Reteporæ*, the number of known species has been raised by the dredgings of the *Challenger* from 31 to between 50 and 60.

The determination and definition of species in a collection so large as that of the *Challenger* Polyzoa, and in a group of organisms in which the differences are far from being always strikingly obvious, cannot but be a work of great labour. The critical examination of the species in such a genus as *Retepora*, for instance, which is represented in the *Challenger* collection by 23 species, and *Cellepora*, which is represented by no fewer than 31, requires no ordinary patience, and the author must be congratulated on having so far brought to a conclusion labours which, in order to be conscientiously performed, must be often wearisome and monotonous.

Among the most important contributions of the Report to the systematic zoology of the Polyzoa is the revision which it contains of *Adeona* and allied genera. A critical comparison of the species of *Adeona* with species belonging to other genera which had been hitherto placed among the *Escharidæ* has necessitated the founding of a new family, *Adeoneæ*, in order to include the whole in a single natural group. This family has several peculiarities, among which the most interesting is the possession by all the species of three different kinds of cells, which the author terms zoœcial, oœcial, and avicularian. Oœcia of the ordinary type are entirely absent, and their function appears to be performed by special cells which differ in form from the others. When decalcified these oœcial cells appear as thick-walled sacs, containing in most cases an ovoid mass, which resembles the contents of an ordinary oœcium, and like these is almost certainly embryonal. Mr. Busk has further made the important observation that in some of them there is lodged instead of this mass a polypide similar to those inhabiting the zoœcial cells, and he concludes that the embryonal mass is derived from a polypide, which it finally replaces.

Among other peculiarities of the Adeoneæ is one which, notwithstanding its apparent triviality, derives importance from its constancy. This consists in the universal presence of a projecting point at each end of the base in the avicularian mandibles both large and small. In doubtful fragments this character alone will often indicate the affinities of the species.

The descriptions of the new species are throughout the work drawn up with that care and precision which characterise all Mr. Busk's zoological writings, while the absence of redundant description and the exclusion of characters not necessary for the diagnosis, give to his definitions a conciseness which will be appreciated as it deserves by all who require to consult the Report.

In a large proportion of the diagnoses the author has had recourse to the chitinous elements of the skeleton. These are the so-termed opercula or oral valves, and the chitinous parts of the avicularia and vibracula; and a very large number of accurately-executed outlines are given in order to show the various forms assumed by these elements in the different species. The employment of the chitinous elements in the classification and descriptive zoology of the Polyzoa is due entirely to Mr. Busk, who has convinced himself that "their value for these purposes cannot be over-rated, while their importance extends far beyond the mere distinction of genera and species."

The descriptions of the species are of course necessarily confined to the hard parts, whether calcareous or chitinous, for, except in living examples, it is rarely possible to determine any facts of importance regarding the soft parts of the colony. The author, however, gives two highly instructive figures of the avicularia of *Bicellaria pectogemma*, in which the muscular apparatus and other soft parts of these curious and still enigmatical bodies are clearly and beautifully represented. In one of his figures of *Carbasea moseleyi* also—a form in which the calcareous walls are quite transparent—there is a very interesting view of the polypides in the interior of their cells.

The distribution of the species, geographical and bathymetrical, finds a prominent place in the Report. An instructive map is appended in which the oceans traversed by the *Challenger* are divided into seven regions, three being to the north and four to the south of the equator, each including 90° of longitude. In each of these regions the stations from which any species of Polyzoa were obtained are indicated.

The bathymetrical range varies within wide limits. The greatest depth which yielded any species to the dredge was 3125 fathoms, in the North Pacific region. From this vast depth four species were procured, and between it and quite shallow water a great number of stations of very various depths are recorded.

One of the most unexpected facts brought out in the Report is the very wide bathymetrical range enjoyed by certain species. Thus *Cribrilina monoceras* is one of the four species brought up from 3125 fathoms in the North Pacific, while the same species was obtained from 1325 fathoms in the South Pacific, from 69 fathoms in the South Indian or Kerguelen region, from 55 fathoms in the South Atlantic, and from 35 fathoms in the Australian region.

This striking difference in the depths inhabited by one and the same species is, however, exceptional; and so is the wide range of geographical distribution which is here presented by a species occurring at great depths. The study of the bathymetrical distribution of the *Challenger* Polyzoa shows that "the extent of geographical distribution is to a considerable degree correlative with the bathymetrical, the wider geographical distribution being in most instances coincident with the shallower depths."

To this law another striking exception is afforded by the beautiful genus *Catenicella*, a genus very rich in species, which, though from comparatively shallow water, are almost exclusively confined to the Australian region.

The thirty-six beautiful plates which illustrate the Report are all that could be desired. Clearly and faithfully drawn, they place in the hands of the zoologist facilities for the determination of the species which, with the descriptions in the letterpress, leave no excuse for erroneous diagnosis.

Though the Report is confined to the species obtained during the expedition of the *Challenger*, the number of these is so large, and the descriptions and figures so exact, that the work will possess a classical value, and be found indispensable by every student of the Polyzoa.

G. J. A.

OUR BOOK SHELF

On the Healthy Manufacture of Bread. A Memoir on the System of Dr. Dauglish. By Benjamin Ward Richardson, M.D., F.R.S. (London: Baillière, Tyndall, and Cox, 1884.)

THIS pamphlet is another of Dr. Richardson's labours in the cause of public health. It deals mainly, as the title implies, with healthy bread, and especially with the system of the late Dr. Dauglish of Malvern for baking what is now generally known as aërated bread. The advantages of the aërated process are stated by the author to be that the destructive influence of fermentation is prevented. There is no chemical decomposition of the flour whatever, and therefore no loss of material, while the rising of the dough is just as effectively carried out. The aërated bread contains, therefore, all the gluten and all the albuminous food of the wheat, out of which the living tissues are constructed, as well as the food which ministers to the animal warmth and vital activity. Moreover, much labour to the baker is spared, and the kneading by hand is wholly dispensed with—a matter of some consideration to delicate or fastidious persons. The gradual steps by which the process has been worked out, from the incubation of the idea in the brain of Dr. Dauglish to the modern aërated process of baking are fully traced by Dr. Richardson, who describes also the different effects of fermentation and aëration on the different qualities of flour, the economic and sanitary advantages of the new system to the workmen (by no means the least important part of the subject, as those who recollect Mr. Lakeman's report on the London bakeries, and who read Chapter IX. of this little work, will acknowledge), and the public advantages of the aërated bread in relation to health. An appendix contains a brief memoir of Dr. Dauglish.

Proceedings of the Edinburgh Mathematical Society. Second Session, 1883-84.

OUR readers have seen from time to time in our "Society" Notices the titles of papers read before this young but from the outset vigorous body, and must have often wished for a more intimate acquaintance with their contents (as the odoriferous steam issuing from the cookshop tempts the hungry "Arab" to enter and feed). We are glad to find, from the volume before us, that the Society is in a position to print its *Proceedings*, for we now know how interesting the papers are. They are not, like some other papers nearer home, caviare to the general, but they deal with matters which come home to every mathematical teacher. Mr. Mackay writes on the circles associated with the triangle, viewed from their centres of similitude; Mr. Muir, on the condensation of a special continuant; Dr. Macfarlane, on voting; Prof. Chrystal, on an application of matrices to spherical geometry, on a problem in partition of numbers, &c. Mr. Allardice furnishes some useful notes on spherical geometry and trigonometry; Mr. Browning, some illustrations of harmonic section; Mr. Barclay, notes on the teaching of elementary geometry (abstract only), and Mr. Traill, proofs of the theorems as far as "Euclid" i. 32, from first principles. Other papers are: a good concise account of Pascal's "Essais pour les Coniques" by Mr. Macdonald; the hypothesis of Le Bel and Van't Hoff, by Prof. Crum Brown; on the representation of the physical properties of substances by means of surfaces, by Mr. Peddie; and a joint account of the problem "La Tour d'Hanoi" (one of displacements), by Messrs. Allardice and Fraser. With these *Proceedings* are bound up Prof. Tait's introductory address on Listing's "Topologie," which, our readers will remember, has been published in the *Philosophical Magazine* (January 1884, pp. 30-46, with plates), and Mr. Muir's Presidential Address entitled "The Promotion of Research; with Special Reference to the Present State of the Scottish Universities and Secondary Schools" (delivered February 8, 1884).

Elementary Text-Book of Trigonometry. By R. H. Pinkerton, B.A. (London: Blackie and Son, 1884.)

THIS elementary text-book of 176 pages contains all the essentials for obtaining a knowledge of trigonometry proper. It might be used either by those who desire merely a thorough grounding in the elements, or, as a first book, by those who intend to take a full analytical course. The arrangement is good, the text well written, and the examples, worked and unworked, are numerous and judiciously chosen. The introductory chapter on the measurement of angles is particularly commendable. We should prefer, however, not to write "$\pi/3$ radians" but "$\pi/3$ radian," reading it "*pi*-thirds of a radian." It may be suggested also to a writer who has the courage to introduce reforms, whether the time has not come for dispensing with the so-called *tablogsines*, *tablogcosines*, &c., and using only logsines, logcosines, &c. *Tabular* log functions are, according to our experience, well-meant aids which only hinder.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*

[*The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to insure the appearance even of communications containing interesting and novel facts.*]

Iridescent Clouds

ON Thursday evening, December 11, about fifteen minutes after sunset, in the south-west direction as seen from the Royal Observatory here, were two rather large clouds about 10° or 12° high, and below them several much smaller ones, all of them of the most brilliantly iridescent colours and nothing but bright colour, of a kind I do not remember to have seen before, though they were not improbably like some described by several of NATURE'S correspondents last year.

The principal cloud, some 5° or 6° long and 2° or 3° across, exhibited a diagonal band of glowing green, passing through blue into exquisite violet on either side, while it was fringed nearly all round by dull red.

The second largest cloud, a little below and rather to the eastward of the first, exhibited all the same colours in similar diagonal bands, but unconformably with the places of the bands of the first produced down to it; though both may have had their bands at right angles to a ray from the sun long since set, but directed on their centres. The sky behind them and all around was singularly dark and sombre, so that these iridescent clouds, in the brightness and richness of their colouring, reminded one more of mother-of-pearl inlaid in a black tea-tray than any ordinary sunset sky.

The smaller clouds of the same kind lower down gradually lost the central green band and passed into yellow and orange, but were still phenomenally bright specks of luminous material on the dark general background. All this towards the south-west; while west and north-west the sky was nearly clear, and exhibited, in a sunset-illumined sky "proper," a fairly fine but quite ordinary set of thin cirro-stratus rolls of cloud, warmly coloured on one side and cold-gray shaded on the other, like any corporeal body in the same exposure.

Lower down still on the horizon was a heavy cumulo-stratus cloud, which the west wind presently brought up to eclipse the green and blue iridescent clouds, proving that they were higher than it, though not so high as the dark cirrus haze to the south-west that had served so well to set forth their brilliant and unusual colouring. C. PIAZZI-SMYTH

Edinburgh, December 13

A STRIKING phenomena, apparently a new phase of the cloud-glows, was widely witnessed here on the 13th, and I myself noticed it, though on a much less scale, and in the north-

east, on the 11th. About 3.30 p.m. the upper edge of a dark, very lofty haze cloud, stretching almost straight from alt. 15° in the south-south-west, to about alt. 20° in the north-west, was fringed with prismatic colours, in parts thrice repeated, separating the dark haze cloud from a bright white haze, like that often seen of late near the sun, which itself was nearly setting. The luminous haze was widest, about 5°, above the sun, and was also, but far more faintly fringed, with a hazy blue sky above. It lasted until 4.20, but at 4.10 the dull cloud was a deep violet, and the bright haze a steel blue. They both seemed to disappear in the dusk, but the bright glow reappeared about 4.40 p.m.

On both occasions the phenomenon lasted long after sunset, and the cloud was quite distinct from the feathery cirri on which, if near the sun, one so often sees prismatic effects. On the 11th the two small oblong clouds affected had the colours in regular bands, in one round a dark, in the other round a bright centre, reminding one of Newton's rings. J. EDMUND CLARK

York, December 15

The "New" Volcanic Island off Iceland

KNOWING the interest which, from their association with the later years of the Gare-fowl's existence, I have long taken in the islets lying off the south-west point of Iceland, Prof. Lütken has most kindly sent me a copy of the Copenhagen newspaper *Dagbladet* for the 7th of this month, containing an article by Capt. C. Normann of the Danish Royal Navy, in command of the ship *Fylla*, during her recent scientific voyage to Greenland, a distinguished officer and an eminent authority in Arctic matters. The article is long—too long for my powers of translation—but, with the friendly help of a Danish young gentleman of this University, I have mastered it, and find it exceedingly entertaining. It treats of the island which, as already announced in these columns (vol. xxxi. p. 37) and elsewhere, is said to have been lately thrust up, as other islands have before been known to be upthrust (at least temporarily) in that volcanic neighbourhood. According to the statement of Mr. Consul Paterson (*loc. cit.*) it is said to have been first observed by the lighthouse-keeper at Reykjanes on July 29; and it would seem that news of its apparition speedily reached Reykjavik; but unfortunately, says Capt. Normann, there was then no ship there available to make search for it. Rather less than a month later, however, the *Dupleix* and *Romanche*, of the French navy, arrived at that port, and the commander of the former, animated with the laudable desire to determine the position of the new island, and if possible to effect a landing upon it, resolved to do so in the course of his homeward voyage, and, with that intent, set out after a short delay. To the surprise of all at Reykjavik, he, as he subsequently informed the French Consul there, could find no trace of the object of his search on August 24. On the departure of the *Dupleix*, however, the commander of the *Romanche* dispatched two of his officers, equipped with proper instruments, by land to Reykjanes, thence to take the bearings of the new island. On August 26 they undoubtedly saw an island corresponding in position with what they expected to see, and reported accordingly to Reykjavik, where Capt. Normann's *Fylla* had arrived on the 25th, on her homeward voyage. The Danish commander, equally enthusiastic in the cause of scientific discovery, accordingly left Reykjavik early on the morning of the 27th, and soon after mid-day his ship was off Reykjanes, whence he pursued a course along the northern side of the bank from which the Fowlskerries emerge, seeing nothing of the new island, it is true, but that time the weather was thick. However, he passed cautiously (as well became a navigator in water liable to volcanic upthrusts) along the whole range, and even beyond the furthest of the emerged skerries—the Geirfugladrángr or Grenadeerhuen, when it began to grow dark, and also to blow. Next morning he turned back, running still along the northern side of the bank. It was clear and beautiful weather, and the rock just named, as well as Eldey or Melsækken, the innermost of the range, stood out in bright sunshine. Breakers marked the position of the old Geirfuglaskér, which sank beneath the waves in 1830, and the neighbouring coast of Iceland, as well as the inland fells, was plainly visible, but nothing in the shape of a "new" island was to be seen. So he came back to about midway between the Meal-sack and Reykjanes—the lead giving a depth of eighty fathoms of water. Thence, thinking that after all there might be some mistake in the reported position of the island, he put his ship's head about, and ran along the southern side of the bank. But again was he disappointed, for no new island met the anxious gaze of all on board.

It remains to be said that a day or two later the *Romanche* came to the same spot, but alas, nothing new was to be found—not even a pumice-stone by which, as Capt. Normann remarks, all decent volcanic islands are expected to indicate their position, even when submerged. Still, the form of the "new" island went on gratifying the vision of the lighthouse-keeper at Reykjanes; and, as Mr. Paterson has told us (*loc. cit*) it was seen by him through a telescope on September 9. I do not for a moment doubt that both he and previously the officers of the *Romanche* saw what was pointed out to them as the "new" island; but, from all that has been said before, and from my own knowledge of the locality, gained during a two months' stay at Kykjuvogr and the neighbourhood in 1858, neither do I doubt that Capt. Normann is perfectly right in asserting that the supposed "new" island is a very old friend of mine—the Geirfugladrángr or Grenadeerhuen before mentioned—the outermost of the emerged Fowlskerries, and our best thanks should be given to that gallant and scientific officer for dispelling the mystery. ALFRED NEWTON

December 14

Overpressure in Schools

I HAVE carefully read Dr. Gladstone's article on over-pressure. Over-pressure is due more to the action of inspectors and teachers than to the requirements of the Code; *e.g.* a teacher in my district has a first class in an infant school, the children being all about six years of age. Owing to the unusual brightness of the children and their regular attendance, the teacher has had no difficulty in training her class in the three R's for first standard work, which, under ordinary circumstances, they could not do until they were a year older and in a higher class. What is the result? An inspector visits that school, finds the children can do much more than is required by the Code, and, without reflecting *how* this has been accomplished, he gives a good report for that class. The following week he visits another school in the same neighbourhood and examines a similar class; these children, he finds, are not so far advanced as those examined the previous week, and therefore he makes a less favourable report, thinking that the teaching-powers are not so good, although the children have really been quite as well taught, and are fully up to the requirements of the Code. When the report comes to the latter school, the teacher cannot understand how it is that the class has not gained the report it deserved, until by and by she hears indirectly what has been accomplished at the school previously examined. Then she says, "If they can do it at that school, we can do it here." Hence *over-pressure*. If inspectors did not examine beyond the Code, teachers would not train children for a higher standard than the Code requires.

Dr. Gladstone says, "Teachers used to be paid partly from the Government grant, and thus had a pecuniary incentive to press forward the feeble so as to insure a pass." That is quite true, but teachers will be found in the future to be quite as anxious as they were in the past as to the results of the examinations. They know quite well that now the salaries are fixed, and do not depend on results, it would be said directly that they did not take the same interest in their work as formerly if perchance the schools passed a less favourable examination, and on this point they are keenly sensitive.

Dr. Gladstone advocates "varied and appropriate occupations in infant schools." It is no doubt very monotonous for little children to be kept closely to the study of the three R's, but there are very few who really like the Kinder Garten as taught in our infant schools, unless it be the Kinder Garten games: it is *not* play, but hard work for such little ones to do. It is impossible for the work to be taught successfully when a teacher has too large a class under her control; in Belgium an assistant mistress has a class of fifty children with a pupil teacher to help her, and then no doubt Kinder Garten can really be carried out with beneficial results to the children, but in the London Board schools, where an assistant teacher has seventy or eighty or even more in her class *without help*, how is it possible to obtain good results? If Kinder Garten is to be taught with success there ought to be a Kinder Garten mistress appointed by the Board to teach it to the children, and I think there are very few teachers who would not agree in this. Of course it would entail extra expense, but it would be an expense more beneficial to the

children than some that are indulged in. These I believe to be the views of nearly all teachers as well as those of myself, who am but a SCHOOL TEACHER

December 8

The Tokio Earthquake of October 15, 1884

AT 4h. 21m. 54s. a.m. the inhabitants of Tokio were awakened by a sudden and violent earthquake. In Yokohama, which lies about sixteen miles south-west by south from Tokio, the disturbance was noted at 4h. 21m. 38s., that is to say, sixteen seconds before it was felt in Tokio. The chief source of error in these time-records—if error exists—will probably be due to observers at different stations having noted time at different portions of the disturbance, the length of which, as determined by the sensations of those who made the records, was about one minute, but, as recorded by a seismograph, between five and six minutes. At the commencement of the disturbance four complete waves were described in three seconds, but at the end of the disturbance the motion became so slow that each wave occupied from two to three seconds. From a record taken by Mr. K. Sekiya, a gentleman whose especial duty it is to attend to the earthquake phenomena of this country, it would appear that the maximum range of motion may have reached 42 mm. The maximum acceleration per second per second was about 500 mm., that is to say, the intensity of the earthquake or its destructive power was similar to that which would be experienced by a building standing on a carriage which was suddenly caused to move with a velocity of about one foot and a half per second, or if, such a carriage having gradually acquired such a velocity, it had been suddenly arrested. The result of the earthquake was to overturn a few chimneys in Yokohama and to crack one or two in Tokio.

Our last severe earthquake was on February 22, 1880. On that occasion in Yokohama very many buildings lost their chimneys and were unroofed, whilst in Tokio the damage was chiefly confined to loosening tiles and shaking down plaster. Had our buildings in Japan been constructed like those in England, it is probable that this last shake would have caused about the same amount of damage as that which was so recently caused by the late disturbance in Essex. From the observations on direction, coupled with what has been said about time, it seems that the earthquake had its origin in Yedo Bay, at or about the same point as that which was determined for its severe predecessor.

It may here be remarked that nearly all the heavier earthquakes which are felt in Tokio and Yokohama practically have had a common centrum. They are not large earthquakes as measured by the area shaken, but they are severe because we are near to their origin.

The earthquake of 1880, according to a record furnished by one of Palmieri's instruments, had an intensity of 78°, whilst the recent earthquake, the actual intensity of which, as deduced by its destructive effect, was much less, is given as 95°.

These intensities measured in degrees really indicate the height to which a certain quantity of mercury in a bent tube was caused to wash—the height of the "wash" being measured by the turning of a pulley connected by a string to a small weight floating on the surface of the mercury. It would seem evident that the magnitude of the records obtained in this manner must among other things depend upon the duration of the earthquake, the period of its waves, and the depth of the mercury contained in the tube. For reasons such as these, records like those just given cannot be regarded as anything more than roughly approximative.

In connection with the remarks made on the amplitude it may be stated that the seismograph by which the record was taken was situated on soft soil in the flat portion of Tokio. This amplitude, had it been recorded on the hard ground of a hill, probably would not have exceeded 25 mm.

One of the most remarkable points connected with this disturbance were the changes in level as observed by the displacement of specially arranged pendulums, which took place before the shock, and again about six hours afterwards.

J. MILNE

Large Meteor

ONE of the largest meteors that I have seen for some years appeared at 7h. 15m. 15s. this evening. It began as a speck, north of Vega, at about 4° greater altitude than that star. The course was perpendicularly down, only disappearing by passing below the horizon. It was 2° east of Vega on descending to the altitude of that star, and by that time had increased to fully a quarter the apparent size of the moon, and this size it maintained whilst above the horizon. The colour was an intense blue, and there was left a streak of orange-red elongated separate stars in its track, and this streak was about 1° in length, although the separate stars of which it consisted disappeared almost as rapidly as they were formed. The stars, like the meteor, increased in size and brilliancy from a mere point, and instantly vanished on attaining their maximum brightness. Each moved perpendicularly down for the length of about half a degree, and left a continuous momentary streak. None of these stars were seen within half a degree of the meteor, and their ignition was confined to the centre of the meteor's path. Their size was tolerably equal, being about that of a second-magnitude star. The speed of the meteor was unusually slow, it being visible for nearly six seconds. The shape was circular in front and cuneate behind (bluntly conical). Its brilliancy was great, considering the presence of a nearly full moon.

Shirenewton Hall, near Chepstow, E. J. LOWE

December 4

The Cost of Anthropometric Measurements

ALLOW me to correct an absurd typographical blunder in the account of my anthropometric laboratory at the Healtheries, which appears in Mr. Ernest Hart's lecture at the Society of Arts. It originally occurred in the *Journal* of the Society of Arts, whence it was copied into your columns (p. 142) last week. The effect of the error to which I refer is to make the statement that the cost of measuring each person at the laboratory in seventeen different ways was 3*l.*, whereas it should have been 3*d.* The subsequent argument, based on the extreme cheapness of the process, becomes in consequence unintelligible. I write myself to make the correction, because the part of Mr. Ernest Hart's address which refers to the anthropometric laboratory was written for him, at his request, by myself. I regret I had not an opportunity of revising it in proof.

FRANCIS GALTON

The Northernmost Extremity of Europe

AS "a Norwegian" now fully admits that the pretended discovery of Capt. Störensen is no discovery at all, but an elementary fact well known and long known to Norwegian geographers, I need not discuss that question any further, but I must protest against his reference to Sönsberg's "Norge," which is the joint production of some of the most eminent men in Norway. Sönsberg is the *editor* and *publisher*.

Amongst the writers who have co-operated to produce the national "Handbook" are the following:—Lieut.-Col. Broch, Chief of the Geographical Survey of Norway (he is the largest contributor, and the writer of the words I quoted), Prof. H. Mohn, Prof. T. Kjerulf, Prof. Rasch, Prof. L. K. Daa, Sorenskriver, H. Thoresen, J. B. Halvorsen (the well-known writer), Beaureauchef Kjer, and Secretary Mohn, Th. Bœck (Royal plenipotentiary), J. N. Prahm, Capt. Scharffenberg, E. Mohn, Lieut. Flood, Capt. Overgaard (the Inspector of Forests), Hörbye, Lieut. Langeberg, and Mr. Langeberg, K. Lassen, Dr. Kahrs, Lieut. Solem, O. T. Olsen, Capt. Bang, Capt. Haffner, and Sörenskriver Nannestad.

All these names are given in the preface, and the contributors of each carefully specified. This was known to "A Norwegian" when he wrote his last letter, for he refers to that same preface, and yet asserts that Sönsberg "never claimed the least *geographical* authority for a faulty and crude guide to tourists" (his own italics). That preface is written for the express purpose of claiming such authority and thanking the authors. It makes special claim in a special paragraph of the *geographical* authority of the "head of the Geographical Survey," Lieut.-Col. Broch, whose name, Sönsberg says, "offers a sufficient guarantee of correctness."

The anonymous "Norwegian," in further disparagement of the book, states that in this preface "the author himself says that for reasons explained it has many faults." I will quote this very damaging confession. It is as follows:—"A few errors and misprints will be found here and there." A list of them is given. After this the flippant misrepresentation of my pretensions in the last paragraph of the letter is not surprising, and demands no further notice.

I make this protest, knowing that NATURE is largely read by

well-educated Norwegians (who all read English as a matter of course). They cannot fail to be indignant if such unjust treatment of a national work, which genuine Norwegians understand and appreciate, is allowed to pass unrefuted. Besides which, Englishmen in search of available and reliable information concerning Norway might be grossly misled.

W. MATTIEU WILLIAMS

APOSPORY IN FERNS

A PARAGRAPH in the report in NATURE (p. 119) of the meeting of the Linnean Society for November 20 last contained what is, to the best of my belief, the first publication of one of the most interesting botanical observations which has been made for some time. As it is quite possible that this brief record may escape the notice of a good many botanists, I venture to give the matter a little more prominence.

At the meeting referred to, Mr. E. T. Druery made a second communication (the first did not, I think, receive any record) upon a singular mode of reproduction in *Athyrium Filix-fœmina*, var. *clarissima*. In this fern the sporangia do not follow their ordinary course of development, but, assuming a more vegetative character, develop more or less well-defined prothallia, which, according to Mr. Druery's observations, ultimately bear archegonia and antheridia. From these adventitious prothallia the production of seedling ferns of a new generation has been observed to take place in a perfectly normal way.

Mr. Druery very kindly offered at the meeting to supply me with some of his material. This reached me on November 29, and I immediately placed it in the hands of my friend Mr. F. O. Bower, who was engaged in other research connected with the vascular cryptogams in the Jodrell Laboratory of the Royal Gardens. Although in the material sent me the abnormal development of the sporangia had not proceeded very far, Mr. Bower obtained evidence which, as far as it went, was entirely confirmatory of the correctness of Mr. Druery's observations. With appropriate cultural treatment prothalliform bodies have already made their appearance, but have not yet reached the stage at which archegonia and antheridia are developed. They are, however, furnished with root-hairs.

This is, however, not all. Mr. Bower placed himself in communication with Mr. Druery, and paid a visit to his collection of ferns. By the kindness of this gentleman he was allowed to bring away specimens of another fern (*Polystichum angulare*, var. *pulcherrima*) which altogether eclipses the *Athyrium*, remarkable as that is. In the *Polystichum* the apex of the pinnules grows out into an irregular prothallium, upon which Mr. Bower with little difficulty was able to demonstrate at Kew the existence of characteristic archegonia and antheridia. In this case the production of the prothallium is not even associated locally with the sporangia, but it appears as a direct vegetative outgrowth of the normal spore-bearing plant. The oophore is a mere vegetative process of the sporophore, a suppression of the alternation of the two generations which exceeds even that which obtains in the flowering plant.

Mr. Druery's discovery, for which I have borrowed Mr. Bower's convenient term Apospory, is the direct converse of the Apogamy in the fern, discovered by Prof. Farlow. In this the sporophore is a vegetative outgrowth from the oophore. The parallel phenomena in the life-history of the moss have been known for some time. But this point and all detailed observations at present available will be dealt with in the communication which Mr. Bower will make at the meeting of the Linnean Society this (Thursday) evening. While every merit must be attributed to Mr. Druery for the first observations of this important fact, he has with great liberality allowed Mr. Bower free liberty to discuss the histological and theoretical points involved.

The obvious possibilities of discovery with regard to the reproduction of ferns may now be regarded as exhausted. It may be interesting to give the dates of the different steps:—

1597	Gerarde	Observed seedling plants near parents.
1648	Cæsius	Sporangia.
1669	Cole	Spores.
1686	Ray	Hygroscopic movements of sporangia.
1715	Morison	Raised seedlings from spores.
1788	Ehrhart	Prothallium.
1789	Lindsay	Germination of spores.
1827	Kaulfuss	Development of prothallium.
1844	Nägeli	Antheridia.
1846	Suminski	Archegonia.
1874	Farlow	Apogamy.
1884	Druery	Apospory.

Royal Gardens, Kew W. T. THISELTON DYER

MODERN ENGLISH MATHEMATICS[1]

YOU will remember that two years ago it was announced from this chair that the Council had settled the conditions under which the De Morgan Medal should be given, and that the first award would be made at the anniversary meeting of 1884.

I have now to make the announcement that the Council has decided that the first medal should be given to Prof. Cayley, in acknowledgment of his work in the theory of invariants.

As this is the first award of the medal, I may remind you of its origin. Soon after the death of De Morgan, some of his admirers started a subscription for the double purpose of having a bust executed and founding a medal to be given in his memory. The *bust* now adorns the library of the London University, where also his valuable collection of books is preserved. The *medal* was offered to the Mathematical Society, and its Council accepted the honourable duty of determining its award. There is a peculiar fitness in the medal being thus connected with our Society; for this Society was founded with the active co-operation of De Morgan by a number of his advanced students, among whom his talented son George, who died soon afterwards, took the lead. De Morgan himself was the first President, and our *Proceedings* begin with a very characteristic opening speech by him.

The medal is to be given for eminent original work in mathematics, and no more fitting memorial than this could in my opinion be devised for a man who spent his whole life in carefully preparing the foundation for such work by his teaching and his writings.

De Morgan was pre-eminently a teacher. His most original work does not so much increase our stock of mathematical knowledge, but is concerned with mathematical reasoning, and with exact reasoning in general.

In the opening speech referred to, De Morgan himself divides exact science into two branches, *the analysis of the necessary laws of thought*, and *the analysis of the necessary matter of thought*. His own work belongs to the former. He was a logician much more than a mathematician in the ordinary sense of the word, and when reading his mathematical works I have always had the feeling that he studied mathematics not so much for its own sake as on account of the logic contained and exemplified in it. I once made this remark in the Professors' Common Room of University College, when an old colleague of his turned round and said, "You are quite right, he told me so himself."

In this work De Morgan did not stand alone. We may almost take him as a type of his period. It has often struck me as a noteworthy fact that in England, after the long pause in mathematical activity, the work taken first in hand was investigation into the very bases

[1] An address delivered by Prof. Henrici, F.R.S., at the annual meeting of the London Mathematical Society (November 13), on the occasion of presenting the De Morgan Memorial Medal to Prof. Cayley, F.R.S.

of mathematics and more particularly into mathematical reasoning. These investigations became partly a mathematical analysis of logic itself and partly a logical analysis of the laws followed by the symbols and operations used in mathematics. De Morgan worked in both directions; we have his "Formal Logic" and his "Double Algebra." Operations were studied quite independently of the meaning given to the symbols. Originally the symbols stood for concrete things, and each operation had its concrete meaning. At present symbols are sometimes used without giving them any meaning whatsoever, and without defining them at all, and then the operations for combining these symbols are arbitrarily defined, with the sole restriction that they do not contradict each other.

Each new set of operations thus establishes a calculus. If afterwards any entities can be found which can be combined by operations answering the characteristics of the operations used in the new calculus, then the latter may be employed for a theory of those entities, and its results will allow of an interpretation. These entities themselves may be anything, concrete things, or logical concepts, or ordinary algebraical quantities.

Thus the ground was already prepared for greatly extending the realm of algebra and the scope and power of algebraical operations, when the genius of Prof. Cayley conceived the idea of invariants [1] which has given rise to that marvellous growth of our science which has suddenly brought England again far to the front.

It was known from Gauss's investigations that for quadratic expressions a certain combination of its constants, its determinant, exists, which has the following property.

If the quadratic expression be transformed into another by a linear substitution, then the determinant of the transformed expression is obtained from that of the original expression by multiplying it by a factor which depends solely on the substitution used.

Afterwards Eisenstein discovered that a similar theorem holds for a cubic expression of one variable. These isolated facts suggested to Cayley that combinations of constants having this property must exist for all algebraical expressions. The problem was how to find these.

The manner in which this has been solved I need not restate here, but I wish to call your attention to the fact that the symbolic methods worked out by the school of mathematicians referred to have been of the greatest use in the development of the theory of invariants, which could scarcely have been brought to its present perfection without it.

It would be an impertinence for me to say much either in praise of Prof. Cayley's work or in justification of the Council's choice. Prof. Cayley has invented and worked out the theory of invariants, and in steady life-long work connected it with nearly every branch of mathematics, enriching everything he touches, and everywhere throwing open new vistas of future work.

The Council of the Mathematical Society in selecting Prof. Cayley as the first recipient of the De Morgan Medal, and thus doing homage to his genius, did so not so much with the idea that it could add honour to his name as that they might add honour to the medal by connecting his great name with it, and thus increase its value for all future recipients. And it is befitting that a body like the London Mathematical Society should give formal expression to the reverence and admiration in which it holds the greatest among its members.

PHYSICAL GEOGRAPHY OF THE MALAYAN PENINSULA

AS some remarks of mine on the mountain system of the Malayan peninsula have already appeared in NATURE, perhaps the following summary of the results of ten months' explorations in the State of Perak will be interesting.

The State of Perak is comprised between the sea (Straits of Malacca) and the main central chain which runs along the centre of the peninsula. Its boundaries are, roughly: north, the River Krian; south, River Bernam; west, the ocean; east, the main central chain. The geology may be briefly described as consisting of—

(1) An immense granite formation, rising into extremely sharp and precipitous parallel ridges having nearly a meridional direction. This granite passes frequently into slates and schists. The prevailing colour is blue.

(2) A Palæozoic formation of slates, mottled sandstones, and clays, forming outliers or detached portions. It is found most abundantly at the foot of the ranges, whence it usually dips away conformably to the slopes of the hills and mountains. It has evidently been subject to great denudation.

(3) Limestone in detached outliers, or isolated hills of precipitous character, showing much denudation. It is stratified or crystalline. No fossils have been found yet, but is probably of Palæozoic age. From its wide extension throughout Perak, where it crops out in so many places, it may have once covered the whole of the granite and Palæozoic clays.

(4) Drifts and alluvium from the ancient streams and river beds. These are formed of the material from all the preceding deposits. All the tin deposits of the country are in these drifts. The ore occurs in a manner very similar to the alluvial gold in Australia, that is to say, in "leads," which are the ancient or modern river beds.

Above these alluvial deposits there is the usual alluvial surface soil, for the most part supporting a very dense vegetation.

The tin deposits hitherto found are all stream tin. No lodes have yet been worked, though there are some in the mountains round the sources of the Perak River. The ore is almost always cassiterite in small abraded crystals. It is of a peculiar blackish-gray or brown aspect. Any person with a little experience would be able to distinguish between tin sand from Australia and that of Perak. The former is rather rich in gems, such as sapphires, rubies, hyacinths, garnets, topazes, and zircons. I have never seen any in Perak; but there is a good deal of fluor-spar, tourmaline, and less frequently wolfram.

The most of the workings are on the western slopes at the foot of the mountains. I cannot recall any instances of mines on the eastern slopes, but the wash or drift seems to have been greater on that side.

The matrix of the tin seems to be in the upper part of the granite at its junction with the Palæozoic clays. In the lower part of the clay there is also a small quantity of tin.

In the drift the tin is always found in nearly the lowest levels, lying in one or two strata from one foot to five feet thick. It is mingled with fine drift sand and gravel. Its position is, I think, due to the repeated sifting and washing it has been subject to in the stream bed. But as it is generally covered by from ten to thirty feet of material destitute of tin, the inference is that only one part of the granite was very rich in the metal.

The stream tin deposits lie upon (1) kaolin clay, or partly decomposed granite; (2) granite; (3) Palæozoic sandstones and clays. In the latter case the stream has come from the denudation of a portion of the same strata on the upper slopes of the hills.

On the highest granite ridges, or those above 5000 feet, there is found a distinct vegetation. Three or four of the genera are Australian (*Melaleuca*, *Leptospermum*, *Podocarpus*, *Leucopogon*), and two of the species (*Leptospermum* and *Leucopogon*) are common Australian forms. Similar facts have been observed in Borneo, but I have

[1] Prof. Cayley, when returning thanks, distinctly waived the claim of priority in favour of the late Prof. Boole. See also Salmon's "Higher Algebra," p. 294.

not heard that they had been observed in the Malay peninsula. Nothing of the kind is seen on the lower slopes of these mountains even 100 feet below the summit. This Australian flora may be the relics of an ancient flora, which once included the Eastern Archipelago. But it does not appear why the species should be confined to the tops of the mountains. They grow in a much warmer climate in Australia.

There are no table-lands in Perak; the mountains are all sharp ridges. There is not the slightest sign of any recent upheaval of the coast-line, while the evidence of subsidence is equally absent. But the land is rapidly encroaching on the sea owing to the immense alluvial wash brought daily from the mountains in this land of heavy rains. Thus the shores are fringed with large mangrove swamps which yearly extend, and the Straits of Malacca form a shallow sea full of mud banks and shoals. The seas are consequently rather poor in certain forms of marine life to which muddy sediment is unfavourable.

Though the tin has been worked for centuries, only a comparatively small portion of the country has been worked out or worked at all. I consider that the deposits in Perak are practically inexhaustible. The mining industry is almost exclusively in the hands of the Chinese, who are almost the perfection of colonists for a country like this. Malays are not good miners. Gold is found associated with tin, but small, scaly, in sparing quantity, and only in one or two places.

There are only two instances known to me of the occurrence of recent volcanic rocks: one is in the Kinta River valley, the other on the western face of a small group of mountains not far to the east-south-east of the island of Penang, and near the Karau River. The rocks appear to be basaltic dykes, but the thick jungle and surface weathering prevented a proper examination.

The mountain system of this native State consists of detached groups of mountains which cover the west side of this part of the peninsula, an almost continuous range close to the sea in the Straits of Malacca. These groups of mountains form parallel chains about thirty miles long, with a direction a little oblique to the true meridional line. Sometimes they are wholly detached groups, so as to allow rivers from the eastward to pass between them. Such an instance is seen in the ranges between the Kinta and Perak rivers. This group terminates to the north so as to allow the River Plus to pass to the westward and to the south so as to give an outlet to the Kinta. Both rivers join the Perak River, which flows round another group (Gunong Bubu), and then flows into the sea in the Straits of Malacca.

The islands of the coast, such as the Dindings and those off the State of Keddah (Pulo Leddas, Pulo Lankawi, and Pulo Buton, known as the Buntings), are probably portions of similar groups, and so are Pulo Penang and the attendant islands. These groups and those on the mainland usually run in sharp parallel ridges, variously modified by oblique spurs, which at times connect the main chains forming watersheds which throw off small streams north-east and south-west.

The following are the principal groups of mountains known to me, beginning at the south:—

Dindings Islands.—Off the coast in front of the Dindings River (*Dinding*, Malay for boundary or partition), lat. 4° 12′ N., there is a series of islands of moderate elevation not exceeding 1000 feet in their highest peaks. They are granite, rich in tin, with a little fine scaly gold. They are densely clothed with jungle, and have fringing reefs of coral. I have visited three or four of these islands, and they are all of the same character.

On the mainland there is a cluster of hills called the False Dindings, from the fact that at a short distance they look like islands. These are also granitic, and tin occurs in the alluvial beds derived from them. They give rise to small rivers, such as the Dindings and its tributaries.

Gunong Bubu.—North-east of this group, but quite detached from it, is a series of parallel mountain ridges with a uniform trend of north-north-east. These ridges are eight or nine in number. The central one is the highest, culminating in Mount Bubu, a fine peak of about 5600 feet elevation. All the ridges are granitic, with occasional patches of metamorphic schists, all more or less rich in tin. A remarkable character in this range is that all the ridges are extremely steep, and frequently interrupted by granite precipices of 1000 feet and more. Gunong Bubu is only accessible in one or two places, the summit being surrounded by escarpments of rock of great height.

Many small streams join the Perak River and the sea from this range. The Kaugsa and Kenas both flow into the Perak to the eastward. In an ascent made by me to the summit of Mount Bubu I was able to explore some of the sources of both these rivers, which afford a home to many a rhinoceros, but few other animals except monkeys (*Hylobates*, *Semnopithecus*, and *Macacus*). The rivers descend many hundred feet in a series of cascades, giving rise to some of the finest scenery in the Malay peninsula.

North of Mount Bubu this group of ridges falls away abruptly, leaving a narrow pass (Gapis Pass) between them and the next group. This pass is about 400 feet above the level of the sea, and therefore too elevated to permit of any river outlet.

Mount Poudok.—In Gapis Pass, or rather at the eastern end of it, there is an isolated hill of highly crystalline limestone. It is an outlier of the great Palæozoic limestone formation already referred to. It is about 400 feet high, and quite precipitous. Its junction with the granite or Palæozoic clays is not visible. Its bright blue and red precipices crowned with dark-green jungle make it a singular and beautiful object, but there are many similar in the State.

Mount Ijau.—North of Gapis another group of ranges succeeds, culminating in Mount Ijau (Malay for green) at about 4400 feet above the sea. This cluster of ridges appears to me to be of nearly the same dimensions as the Mount Bubu group, but not so high by 1000 feet or so. I estimate that each group is from twenty to twenty-five miles long, and fourteen to sixteen broad, covering an area of about 400 square miles. This, however, is only a rough estimate formed from views I have been able to obtain from the summits of other mountains. I have not been able to examine personally the termination of the Mount Ijau group on the north. From the sea one is able to perceive a distinct pass like that of Gapis. It is probably about the same height, and does not form the outlet of any river from the eastern side.

Kurau Group.—North of Gunong Ijau is another group, which I do not know how to distinguish except that it forms the watershed of the Kurau River. Its highest point is a mountain which is also called Ijau by the Malays. I have not ascended the peak, but it seemed to me less elevated than Mount Ijau to the south.

Mount Inas.—What the Malays of Keddah call Mount Inas is the highest point of another detached group north of the Krian and Selama Rivers. I have been within a few miles of the foot of this mountain, and it seemed to me to be somewhat over 4000 feet high, and the highest point of an isolated group of ridges.

Keddah Peak.—North of Mount Inas, in the State of Keddah, there is, close to the sea, a detached group of mountains, at the foot of which the Keddah River flows. Keddah Peak is the highest summit,—probably over 4000 feet high. This is in what is called Lower Siam, in which I have only travelled to a very trifling extent north of the Krian River, the boundary of Perak State. In the north of Perak, near Patani, we have other groups of mountains. An Italian explorer named Bozzolo, who

has lived many years in Siam, assures me that he has travelled round the Gunong Kendrong group at the head of the Perak, and that it is quite detached from any other hills.

Perak River.—The whole of these groups are sufficiently connected to prevent any drainage from the central range flowing directly to the west coast of the peninsula. Thus the Perak River, which has its sources in the Keddah and Patani Mountains flows to the southward for over 180 miles. In its course it is joined by two important rivers from the eastward, namely, the Plus and Kinta.

Plus River.—The Plus River has its sources in the high mountain groups east of Mount Inas, and in the main range. It flows round the southern end of a group called by some the Bukit Panjang Range, and then joins the Perak.

Kinta Ranges.—South of this junction is a group of mountains called by some the Kinta Ranges. This group is about twenty-five miles long. It is perfectly detached from all the others, having a generally north and south direction, but sending off spurs from its west side a little to the west of south. The group is entirely granitic, but on its lower slopes has thick deposits of limestone belonging to the formation already referred to, above and below which tin is worked. For about twenty-five miles this range separates the valley of the Perak River from that of the Kinta, which flows on its eastern side. The highest peaks rise to about 3750 feet above the sea, and give rise to small streams which all flow into the Perak. There is a remarkable uniformity in three or four of the highest summits, which are about the centre of the chain, Mounts Merah (red), Prungin, &c. They are all within a few feet of the same height. From these mountains the range falls away gradually to the south, and sends off two considerable spurs to the south-west. Where it ceases the River Kinta joins the Perak.

Kinta Valley.—The valley of the Kinta River is about as wide as that of the Perak. The river flows, like the Perak, on the eastern side of the valley. The eastern tributaries are many and important. On the sides limestone granite and schistose slates crop out. To the eastward there are many detached hills of limestone fronting the main central chain. They form very characteristic features in the landscape, from their precipitous outline, and the brilliantly coloured faces of blue, green, and bright red rock. They are also distinguished by a different vegetation.

Perak Valley.—The valley of the Perak River is bounded by the groups of mountains already described on the west; on the east by the Kinta Range, and north of the Plus by the Bukit Panjang Range. The river flows on the eastern side of the valley; this is owing to the many spurs and outliers on the eastern sides of Mounts Bubu and the Ijau Ranges. It seems as if there had been much less denudation on the eastern than on the western sides of the range. This may be owing to the prevailing rains falling more abundantly on the western than on the eastern sides of the mountains.

As a consequence of this the tin workings appear to be, with little exception, on the western sides of the ranges, where the waste and wash has probably been greater.

Batu Kurau.—Between Mount Bubu Range and Mount Ijau Range and the sea there are no hills except small outliers, mostly of Palæozoic clay, which have evidently belonged to the ranges. But north of the Larut River there is an isolated limestone mountain near the Kurau River. This is called Batu (stone or rock in Malay) Kurau. It is very similar to Mount Poudok in the Gapis Pass. It is quite unconnected with the main range, and rises out of the plain between the spurs which form the valley of the Kurau River. There is also a small detached range dividing the valley of the Krian River from that of the Kurau.

Main Range.—Of the main range I know but very little from personal observation, having only visited it at Goping, and at the limestone hills, where the tin is worked on the Diepang River. But I have travelled along the most of the Kinta Valley skirting the base of the range either on foot or in boats. I have also traced the valley of the Kampar River. The geology is like the rest of the country, mainly granite, slates, and limestone, with traces of basaltic rocks. The general structure of the range can best be judged from some of the mountains to the westward. It forms a most imposing boundary to the whole of the western horizon. In the north, about the sources of the Plus River, there is a mountain of rounded outline, probably over 6000 feet high. The range there declines a little, with a somewhat serrated outline, but generally over 3000 feet. At a point corresponding with the latitude of about the centre of the Kinta Range, or opposite the Gapis Pass, the chain increases in elevation to perhaps over 5000 feet, and in the distance is seen a peak which must be over 8000 feet high. I know no name for this hill, but it is the most distant mountain usually seen. South and west of this the chain rises into a grand cluster of peaks, the highest of which is over 7000 feet. This is Gunong Robinson. It looks higher than the Sugar-Loaf Hill as seen from Gunong Bubu, but then it is much nearer. From Gunong Robinson the range declines to the southward, but is still a bold series of picturesque peaks, many of which must be over 6000 feet. It has been asserted by more than one observer that to the south of the point where the range is lost sight of from Arung Pura, there is a high mountain occasionally visible higher than any other in the main range, and probably over 12,000 feet. This I have not seen, but I am convinced that there are many things yet to be learned about the most elevated portions of this mountain chain. Seen from any point of view, it forms a magnificent mountain prospect. Its mysterious unexplored recesses are rendered more gloomy than any scene in the world from the dense forest and the masses of vapour and cloud with which they are always clothed. A few savage Sakies are the only inhabitants. I may add that perhaps in no country in the world is exploration rendered so difficult from the extraordinary thickness of the jungle and the steepness of the mountain ridges which unceasingly cross the traveller's path.

Penang, September 8 J. E. TENISON-WOODS

A NEW APPLICATION OF SCIENCE

DR. FERRIER'S researches on the brain, to which we have often drawn attention in these columns, have lately received an application of the most startling character. What this application is cannot be better stated now than in the accompanying letter, signed "F.R.S.," which appeared in Tuesday's *Times*. We shall return to this subject next week.

"While the Bishop of Oxford and Prof. Ruskin were, on somewhat intangible grounds, denouncing vivisection at Oxford last Tuesday afternoon, there sat at one of the windows of the Hospital for Epilepsy and Paralysis, in Regent's Park, in an invalid chair, propped up with pillows, pale and careworn, but with a hopeful smile on his face, a man who could have spoken a really pertinent word upon the subject, and told the right rev. prelate and the great art critic that he owed his life, and his wife and children their rescue from bereavement and penury, to some of these experiments on living animals which they so roundly condemned. The case of this man has been watched with intense interest by the medical profession, for it is of an unique description, and inaugurates a new era in cerebral surgery; and now that it has been brought to a successful issue, it seems desirable that a brief outline of it should be placed before the general public, because it illustrates vividly the benefits that physiological explorations may confer on mankind, shows how speedily useful fruit may be gathered from researches undertaken in the pursuit of knowledge and with no immediate practical aim, and reveals

impressively the precision and veracity of modern medical science.

"This case, then—this impressive and illustrative case—is that of a man who, when admitted to the Hospital for Epilepsy and Paralysis, presented a group of symptoms which pointed to tumour of the brain—a distressing and hitherto necessarily fatal malady, for the diagnosis or recognition of which we are indebted to bed-side experience and post-mortem examination. But while clinical and pathological observations have supplied us with knowledge which enables us to detect the existence of tumours of the brain, they have not afforded us any clue to the situation of these morbid growths in the brain mass, and it was not until Prof. Ferrier had, by his experiments on animals, demonstrated the localisation of sensory and motor functions in the cerebral hemispheres that the position of any diseased process by which they might be invaded could be definitely determined. By the light of these experiments it is now possible in many instances to map out the seat of certain pathological changes in these hemispheres with as much nicety and certainty as if the skull and its coverings and linings had become transparent, so that the surface of the brain was exposed to direct inspection. And thus in the case to which I am referring, Dr. Hughes Bennett, under whose care the patient was, guided by Ferrier's experiments, skilfully interpreted the palsies and convulsive movements which the man exhibited, and deduced from them that a small tumour was lodged at one particular point in his "dome of thought," and was silently and relentlessly eating its way into surrounding textures. Not more surely do the fidgetings of the electric needle intimate their origin and convey a meaning to the telegraph clerk than did the twitchings of this man's muscles announce to Dr. Hughes Bennett that a tumour of limited dimensions was ensconced at a particular point of a particular fold or convolution of the brain—the ascending frontal convolution on the right side.

"Very brilliant diagnosis this, it may be remarked, and nothing more. A conclusion has been arrived at which, should it prove correct, will gratify professional pride; but as it cannot be confirmed or refuted until the poor patient is no longer interested in the matter, and cannot be made the basis of any active interference, no great advance has been made after all, and vivisection has yielded only some barren knowledge. Until quite recently, criticism of this kind would have been justifiable in a sense, but now it is happily no longer possible, for another series of experiments on living animals, undertaken by Profs. Ferrier and Yeo, have proved that through our power of localising brain lesions we may open a gateway for their removal or relief. The old notion that the brain is an inviolable organ with *noli me tangere* for its motto—a mysterious and secluded oracle of God that simply falls down and dies when its fane is desecrated by intrusion—has been dissipated by these experiments; and we now know that under punctilious antiseptic precautions the brain, in the lower animals at any rate, may be submitted to various operative procedures without risk to life or fear of permanent injury. Emboldened by this knowledge, Dr. Hughes Bennett devised a way of helping his patient whose disease he had diagnosed with such remarkable exactitude, and gave him one chance, if he had the courage to embrace it, of saving his life and recovering his health.

"The patient had the position in which he stood faithfully explained to him. He was told that he laboured under a malady which medicines were powerless to touch, and that if left unassisted he must die in a few months at latest, after prolonged sufferings similar to those which had already brought him to the verge of exhaustion, and which could be only partially alleviated by drugs; but that one outlet of escape, narrow and dangerous, but still an outlet, was open to him in an operation of a formidable nature and never before performed on a human being, under which he might, perhaps, sink and die, but from which he might, perhaps, obtain complete relief. The man, who had faith in his doctor, and no fine-spun scruples about availing himself of the results of vivisectional discoveries, eagerly chose the operation. On the 25th ult. accordingly, Mr. Godlee, surgeon to University College Hospital, in the midst of an earnest and anxious band of medical men, made an opening in the scalp, skull, and brain membranes of this man at the point where Dr. Hughes Bennett had placed his divining finger, the point corresponding with the convolution where he declared the peccant body to be, and where sure enough it was discovered. In the substance of the brain, exactly where Dr. Hughes Bennett had predicted, a tumour, the size of a walnut was found—a tumour which Mr. Godlee removed without difficulty. The man is now convalescent, having never had a bad symptom, and full of gratitude for the relief afforded him. He has been snatched from the grave and from much suffering, and there is a good prospect that he will be restored to a life of comfort and usefulness. In that case he will be a living monument of the value of vivisection. The medical profession will declare with one voice that he owes his life to Ferrier's experiments, without which it would have been impossible to localise his malady or attempt its removal, and that his case opens up new and far-reaching vistas of hopefulness in brain-surgery. Many men and women will henceforth, there is reason to anticipate, be saved from prolonged torture and death by a kind of treatment that has been made practicable by the sacrifice, under anæsthetics, of a few rabbits and monkeys."

NOTES

THE Council of the British Association for the Advancement of Science has requested the following to allow themselves to be nominated as Presidents of Sections for the meeting at Aberdeen, which begins on Wednesday, September 9, 1885:—Section A (Mathematics, &c.), Prof. J. C. Adams; Section B (Chemistry), Prof. Armstrong; Section C (Geology), Prof. Judd; Section D (Biology), Prof. McIntosh; Section E (Geography), General Walker; Section F (Economics), Prof. J. Bryce; Section G (Mechanics), Mr. B. Baker; Section H (Anthropology), Mr. F. Galton.

WE learn with pleasure that M. Mascart was on Monday last elected a Member of the Academie des Sciences, Paris.

THE Berkeley Research Fellowship has been given by Owens College, Manchester, to Mr. G. H. Fowler of Keble College, Oxford. An opportunity is thus given to Mr. Fowler of carrying on his work on the anatomy of the Zoantharian corals.

THE immense economical importance of Government botanic gardens, especially in young colonies, is well shown by the last report of the Curator of the Gardens in Brisbane. Omitting the distribution of ornamental trees, shrubs, &c., to the gardens of public institutions, as well as that of ornamental pot plants, we find that economic plants have been distributed on a very large scale. The demand for these has been unprecedentedly large, and no application is ever refused so far as it can be supplied. About 3000 economic plants were sent out during the year; these consisted chiefly of various kinds of coffee, tea, cocoa (*Theobroma cacao*), cinchona, and vanilla. Grafted Indian mangoes and plants of the Brazilian nut (*Bertholletia excelsa*) have been given to likely growers, and the demand for the latter is so great that application has been made to the universal feeder of these institutions, Kew, for more. Besides acting as a collecting and distributing agency, the Brisbane Gardens do what is perhaps of even more value, viz. ascertain by experiment the conditions under which certain foreign plants will grow best in the colony. The most important trials recently have been with regard to cinchona, which, Mr. Pink shows, may by care in its early stages, be successfully cultivated in Queensland. The hop plant has been tried, and appears a success, 10 cwt. being the produce per acre the first season, while in England under similar circumstances it is only 4 cwt. Sugar is at present the staple of the colony, but no efforts are spared to discover new kinds elsewhere which may be better adapted to the place. 100 tons of various kinds of cane, chiefly from Mauritius, were sent to planters during the year. Economic and valuable timbers also receive much attention, and the gardens have now ready for transplanting 20,000 trees of various kinds, including cedars, olives, silky oak, English oak, English ash, poplars, and chestnuts. The recent experiments have conclusively shown that Queensland can introduce among her staple produce-crops such valuable and remunerative products of the soil as coffee, hops,

and cinchona. As an example of the care and labour devoted to the work, it may be mentioned that every method of cultivating the cinchona in Ceylon and South America was tried in the gardens without much success; and finally Mr. Pink was compelled to devise a method of his own, which proved successful.

WE regret to announce the death of Dr. Heinrich Bodinus, for many years Director of the Berlin Zoological Gardens; he died at Berlin on November 23 last. Also of Dr. Karl von Vierordt, formerly Professor of Physiology at Tübingen University; he died at that place on November 22, aged sixty-seven.

La Nature records the death of M. Henri Lortigue, to whom is due the practical introduction of the telephone in most of the large towns in France, and who was in many other respects a man of scientific note. In 1855 he was employed by Leverrier, the Director of the Paris Observatory, who was then organising a series of meteorological observations, to superintend the instruments by which, by means of photography and electricity, the slightest variations of the barometer, thermometer, and compass were recorded. In 1859 M. Lortigue took charge of the telegraph service on the Chemin de Fer du Nord, and received a gold medal for his various inventions of semaphores, automatic whistles, &c. In 1880 he was Director of the Société des Téléphones. He was also a botanist and entomologist of note, and has left behind him some excellent collections in natural history.

THE part of Turkestan bordering on China and comprising the countries retroceded by Russia, is now entirely incorporated with the Chinese Empire, and will form henceforward the 19th Province.

WE have received from Messrs. Collins of Glasgow the new edition (twentieth thousand) of Prof. Guthrie's well-known "Text-Book of Magnetism and Electricity." Not only has the present edition been carefully revised, but it contains a supplementary chapter by Mr. C. V. Boys, referring chiefly to the practical applications which have been made of electricity during the last few years, such as the telephone and microphone, dynamo machines, electric light, secondary batteries, &c. Electric and magnetic units are also referred to at some length.

OUR readers will be glad to know that the Fine Art Society announces the publication of an etching of Prof. T. H. Huxley, after the picture painted by Mr. John Collier, which was exhibited at the Royal Academy in 1883. The etching is the work of the distinguished etcher, M. Léopold Flameng, and corresponds in size with the portrait of the late Mr. Charles Darwin, painted and etched by the same artists, and published by the same Society last year.

AN examination of a series of water-marks set in 1750 all round the Swedish coasts, from the mouth of the Tornea to the Naze, in order to settle a dispute between the Swedish astronomer Celsius and some Germans, as to whether the level of the Baltic has been rising or sinking, shows that both parties were right. The gauges were renewed in 1851, and again this year, and have been inspected regularly at short intervals, the observations being carefully recorded. It appears that the Swedish coast has been steadily rising, while that on the southern fringe of the Baltic has been as steadily falling. The dividing line, along which no change is perceptible, passes from Sweden to the Schleswig-Holstein coast, over Bornholm and Laland. The results have lately been published by the Swedish Academy of Sciences; and it appears from them that while during this period of 134 years the northern part of Sweden has risen about 7 feet, the rate of elevation gradually declines as we go southwards, being only about 1 foot at the Naze, and nothing at Bornholm, which remains at the same level as in the middle of the last century. The general average result would be that the Swedish coast has risen about 56 inches during the last 134 years.

THE Central Geodynamic Observatory at Rome recently received notice from Corleone, in the province of Palermo, of another violent shock of earthquake, making the fourth in Italy in less than a fortnight. The first occurred on November 23, at 7.30 p.m., on the eastern slope of the Western Alps, and coincided with the reawakening of Vesuvius. The second, at midnight on the 27th, extended from the same region to Switzerland and Lyms on the north, and to the Liguarian coast of Italy. The third, at midnight on the 29th, shook Cosenza and Paola in Calabria. The fourth touched Sicily at Corleone at four o'clock in the afternoon of the 5th inst. During this period an unusual agitation had been noted in the seismographic instruments at Rome and elsewhere in Italy. Prof. Di Rossi, Director of the Geodynamic Observatory, announces the early publication of very interesting observations taken at Rocca di Papa, comprising the alterations in level, and in the temperature of subterranean waters.

A NOTICE has just been received from M. Hepites, who has long been carrying on meteorological observations in Roumania, to the effect that the Roumanian Government has decided on the establishment of a meteorological organisation, and has voted the necessary funds. The Central Institute is being built at Bucharest. The organisation was started July 1. M. Hepites is the director.

IN a paper recently read before the Shanghai branch of the Royal Asiatic Society, Dr. Macgowan affirms the claims of the Chinese to be the originators of gunpowder and firearms. This claim was examined in an elaborate paper some years ago by the late Mr. Mayers, and decided by him in the negative. Dr. Macgowan admits that gunpowder as now used is a European discovery. Anterior to its granulation by Schwartz it was a crude compound, of little use in propelling missiles; this, says the writer, is the article first used in China. The incendiary materials stated by a Greek historian to have been employed by the Hindus against Alexander's army, are stated to have been merely the naphthous or petroleum mixtures of the ancient Coreans, and in early times used by the Chinese. The "stink-pots," so much used by Chinese pirates, is, it appears, a Cambodian invention. Dr. Macgowan states also that as early as the twelfth or thirteenth century the Chinese attempted submarine warfare, contriving rude torpedoes for that purpose. In the year 1000 an inventor exhibited to the then Emperor of China "a fire-gun and a fire-bomb." He says that while the Chinese discovered the explosive nature of nitre, sulphur, and charcoal in combination, they were laggards in its application, from inability to perfect its manufacture, so, in the use of firearms, failing to prosecute experiment, they are found behind in the matter of scientific gunnery.

IN *The Hull Quarterly and East Riding Portfolio*, edited by W. G. B. Page, Sub-Librarian of Subscription Library, Hull, will appear, during the year 1885, interesting articles by T. M. Evans, President of the Literary and Philosophical Society, Hull, on the ancient Britons and the lake-dwelling at Ulrome in Holderness; A. C. Hurtzig, C.E., on some tidal and engineering features of the River Humber; and William Lawton, on the meteorology of Hull.

THE Leicester "Literary and Philosophical," now entering upon its jubilee year, appears to be a flourishing society in a flourishing town. Over 300 members distribute themselves into five sections, containing many ladies as Associates, and both making outdoor excursions for practical observation, and holding evening meetings at which lectures are given, professional as well as amateur, followed at the latter by discussions. These lead to the collection and distribution of valuable knowledge of archæology, literature, and economics; of astronomy, physics,

and chemistry; of geology, where the exposures made by local railway cuttings are carefully studied and recorded; of biology (combining botany and zoology); and of zoology, specially directed to the study of the animals of the county, a list of which will be published as it approaches completeness. Some of these productions are not among the abstracts at the end of the Report, being reserved for publication in "another place." These papers are read in a new lecture-hall adjoining the Museum, another institution which, though not very extensive, is in a most active state of growth and improvement. A new curator has led to a thorough rearrangement of the zoological collection in such cases and surroundings as show the specimens in their natural habitats, with index sketches attached to each case, supplying names, &c., hanging near. So large an outlay has been made upon these cases, that only 4 per cent. of the expenditure has been devoted to fresh objects. A large increase in the number of visitors has followed these reforms, and nothing, we venture to say, would so increase the attendance at a museum as the introduction of variation instead of rigid order, and the contributions from South Kensington can best assist in this "movement." It seems hardly possible than an institution like this should be frequented by persons engaged in business when the hours of opening it are only the middle hours of the business day, viz. from ten till four, and the fact that on a holiday like Whitsun Monday 97 persons per hour were admitted during the daytime, and 353 persons per hour were admitted in the evening, shows that, here at any rate, the latter hours are the favourite hours also. Why, on the same ground, should a series of "popular" lecturettes be given at three o'clock in the afternoon?

Dr. A. Penck has recently studied the old glaciers of the Pyrenees in detail, and has found remarkable differences between them and the Alpine glaciers of the Ice period. Even at that remote period the Pyrenean glaciers were of far smaller extent than those of the Alps—in the western part of the Pyrenees indeed there existed not a single one. Wherever traces of glaciers could be found they were accompanied by lake beds; these have by now been filled up for the greatest part, at least in the lower altitudes, the only lakes still existing being situated in altitudes of between 1500 and 3000 metres.

We have received a pamphlet on the climatic conditions of Luxor and Egypt, with especial reference to invalids, by Dr. Maclean (H. K. Lewis). The author spent three years as an invalid and also in the practice of his profession in Egypt. There are several meteorological tables and diagrams, and very much information of all kinds for the traveller, although the traveller who wants to escape the English winter is the special object of the writer's solicitude.

Prof. Lindström, the keeper of the palæontological collections at the Stockholm Museum, has made an interesting discovery amongst a number of petrefacts obtained from the Island of Gothland. It is an air-breathing crustacean from the Silurian period, the first specimen of the kind yet found.

Prof. Gustav von Hayek, the author of the well-known "Atlas of Natural History" (published by Perles of Vienna), has received the gold medal for arts and sciences from the Emperor of Austria, in recognition of the excellence of the work referred to.

We learn from *Science* that Commander Bartlett's annual report on the operations of the U.S. Hydrographic Office makes a good showing for activity and enterprise. Lists of light-houses and "Notices to Mariners," in which bearings are given in degrees from true north, instead of magnetic bearings in points, as formerly, have been liberally published; the official correspondence with other hydrographic offices has been increased; and a complete set of the charts issued by all nations is kept on file, and is always at the service of the public for the determination of any questions relating to hydrography. The only vessel engaged in making surveys during the year was the *Ranger*, on the west coast of Mexico and Central America; but it is strongly recommended that new surveys be undertaken in several regions where they have long been wanted. The charts of the northern coast of South America are mostly based on old Spanish surveys dating back to 1794. "Watson's Rock," latitude 40° 17′ N., longitude 53° 22′ W., in the path of North Atlantic traders, has been reported so many times that its existence ought to be definitely settled or unsettled. The recommendation of previous hydrographers with regard to surveys of the Caroline and Marshall Islands, in the equatorial Pacific, should no longer be neglected; they lie in the belt of the trade-winds and westerly current, the natural highway of vessels crossing the ocean to Japan, China, and the East Indies, and require immediate examination. In the North Pacific alone there are over 3000 reported dangers that need decisive observation. In many cases the same island has half a dozen different positions, with as much as fifty miles between the extremes. It is urged that every naval vessel be provided with modern sounding-apparatus, by which even deep-sea measures can be quickly made, and required to sound wherever the charts show no depths reported within twenty miles on any side; and it is desired that a ship should be fitted out expressly to make investigations into ocean temperatures at all depths, and thus obtain data necessary to complete the determination of the actual oceanic circulation.

M. Guinet, a rich burgher of Lyons, having spent some years of his life and 200,000*l.* of his money in the erection and furnishing of a museum, recently opened in his native town, intended to illustrate the religions of the East, has further applied to have the establishment transferred to Paris, where it would be likely to interest and instruct a larger number of visitors. He has, in addition, offered to consign the whole into the hands of the Government under certain conditions, an offer which has been accepted. A number of priests belonging to the Buddhist and Brahmanic religions are to be brought to Paris, and at fixed salaries employed in translating historical and liturgical books connected with their respective faiths.

The French Government have bestowed fresh honours on the officers of the Meudon steering balloon, one of them having had his name put down on the list for the distinction of a "Chef de Bataillon," while another has been made a knight of the "Légion d'Honneur," and a third, who was wounded in preparing the hydrogen gas, has had the same distinction awarded him. At the same time that we observe the services of these gallant officers so well appreciated, we learn that the steering balloon has been dismantled without undergoing any new experiments, nor do we hear that the Commission appointed by the Academy of Sciences to report on the balloon has published any verdict respecting it.

The Municipal Council of Paris having been called on to vote on the question of a site for the Centennial Exhibition of 1889, have selected the Champ de Mars, the ground on which former exhibitions were held. This unexpected vote on a matter to which in the circumstances of the case great importance was attached has caused a considerable amount of sensation.

"Celsus and his Works" was the subject of the first of a course of lectures during the current session, delivered at the Faculty of Medicine in Paris, by M. Laboulbène. The course is to be devoted to a history of the principal discoveries in medicine and surgery, and the lectures are to appear in the *Revue Scientifique*.

A COMMISSION has been appointed by M. Cochery to determine the conditions of security requisite for laying electric cables to transmit currents of high tension. This step has been taken in connection with the experiments conducted at Creil and the Gare du Nord with the Marcel-Deprez system, as well as others which may be in preparation.

THE observer at the meteorological station on the summit of the Obir (Carinthia) reports that on October 11, at 8.15 p.m., he saw a beautiful display of St. Elmo's fire. The points of the vanes, the telephone wires, and the tops of the posts supporting this wire shone brilliantly in a whitish-blue light.

THE additions to the Zoological Society's Gardens during the past week include a Bonnet Monkey (*Macacus sinicus* ♀), a Macaque Monkey (*Macacus cynomolgus* ♂) from India, presented by Mr. John Roberts; a Bonnet Monkey (*Macacus sinicus* ♂) from India, presented by Mr. David McCance; a Montagu's Harrier (*Circus cinerascens*), European, presented by Lord Lilford, F.Z.S.; a Banded Gymnogene (*Polyboroïdes typicus*) from West Africa, a Gold Pheasant (*Thaumalea picta* ♂) from China, an Indian Python (*Python molurus*) from India, deposited; three Lions (*Felis leo*), born in the Gardens.

OUR ASTRONOMICAL COLUMN

THE BINARY STAR α CENTAURI.—In the last number of the *Monthly Notices* of the Royal Astronomical Society, Mr. E. B. Powell, so favourably known for his excellent measures of double-stars, made during his residence in India, has a note in which he gives reasons for concluding that the period of revolution of this most interesting binary is longer than has been assigned by the later calculations of its orbit, and, instead of a period of 77½ years, which is about that found by Dr. Elkin, he considers that one of 86 or 87 years is better supported by the earlier observations, viz. those by Richaud at Pondicherry in December, 1689, and by Feuillée at Lima on July 4, 1709. The results of an investigation by Dr. Doberck, communicated to the writer early in 1879, rather tend to support Mr. Powell's conclusion. Dr. Doberck's elements, which are professedly only provisional ones, are as follow:—

Periastron passage	1875·12
Node	° ′ 25 32
Angle between the lines of nodes and apsides ...	45 58
Inclination	79 24
Excentricity	0·5332
Semi-axis major	18″·45
Period of revolution	88·536 years.

In this orbit the angle and distance at the epochs of the observations of Richaud and Feuillée would be:—

1689·95	...	Position,	14°·9	... Distance,	9″·54
1709·51	...	,,	200°·8	... ,,	14″·74

ENCKE'S COMET.—The elements of this comet for the approaching perihelion passage are as follow, according to the calculations of Dr. O. Backlund of Pulkowa:—

Perihelion passage 1885, March 7·6523 G.M.T.

Longitude of perihelion	° ′ ″ 158 32 45·0	Mean
,, ascending node ...	334 36 54·6	Equinox
Inclination	12 54 0·1	1885·0
Angle of excentricity	57 45 20·5	
Mean daily sidereal motion ...	1072″·97311	

The corresponding period of revolution is 1207·86 days. An ephemeris for January will appear next week.

BARNARD'S COMET.—Prof. Frisby of Washington has calculated elliptical elements of this comet from observations made at the Naval Observatory between August 12 and October 20, and therefore extending over sixty-nine days. The period of revolution in his orbit is 1878·65 days, or 5·143 years, but this element does not appear to be as yet very closely determined, much less so indeed than in the case of the second new comet of short period detected during the present year by Wolf. In Prof. Frisby's orbit the distance of the comet at aphelion from the orbit of Jupiter would be 0·705, the aphelion distance being 4·683, therefore considerably within the orbit of the planet; at the ascending node the comet's distance from the sun would be 1·552, and at the opposite node 3·942. Taking these conditions into account, it would appear probable that it has been long moving in its actual orbit. The comet, however, belongs most likely to the fainter class of those revolving in short periods, and in the present year has been observed under somewhat favourable circumstances: it approaches nearest to the earth when the perihelion passage takes place between a fortnight and three weeks earlier than in 1884. On November 20, M. Perrotin observing with the Gauthier-Eichens equatorial of the Observatory of Nice, aperture 0·38 m., found the comet near the limit of vision for that instrument; he remarks:—"Pour la rendre sensible à l'œil et bien saisir sa position exacte, on était obligé d'agiter legèrement la lunette en ascension droite, tantôt dans un sens, tantôt dans l'autre." The position determined for that evening was as follows:—

Nov. 20 at 7h. 25m. 38s. Nice M.T. R.A. 22h. 38m. 21·85s., N.P.D. 97° 18′ 20·4″.

The Observatory of Nice (Mont-Gros), established through the munificence of M. Bischoffsheim of Paris, is in longitude oh. 29m. 12·2s. east of Greenwich, and in latitude 43° 43′ 16″·7.

GEOGRAPHICAL NOTES

THE correspondent of the *Times* with the Afghan Boundary Commission, writing from Khwaja Ali on October 16, describes the march of the expedition from Quetta to the Helmand. The geologist, Mr. Griesbach, describes the geological features of the country as much the same as those seen in the Pishin and Candahar country, viz. steep, deeply-eroded mountain ranges with a general strike of north, south to north-east, south-west, the intervening valleys being filled by Post-Tertiary deposits, which form extensive plains and glacis. The ranges of hills are more or less continuations of ranges, which are crossed by the Quetta-Candahar road. After leaving Kanak, one crosses the south-western end of the Ghaziaband range, which is composed of sandstone, shales, and grits of the "flysch" facies of the Eocene rocks. Beyond that range one enters the southern extension of the Lora plain of the Pishin. The white and coloured clays of the Siwaliks, seen from Dina Karez in the Pishin, are again seen (afar off) from Panjpai, and no doubt they underlie most of the Post-Tertiary deposits which form the surface of these wide valleys). The low ridges between Panjpai and Nushki are composed of sandstones, flaggy limestone beds, and friable shale, identical with the "Soliman" sandstone, and entirely belonging to the Lower Cretaceous series. The contact between the hippuritic limestone and the trap contains in the Candahar district gold (with traces of nickel) and galena ores. The water found below the surface is the natural drainage from the hills, contained in the gravels and sands of the Post-Tertiary fan deposits, inclosed between the clays of the Siwaliks below, and the recent conglomerate (a kind of kankar) above.

DR. CHAVANNE, who visited the Congo by order of the Brussels Geographical Society, has returned to Lisbon for a short period in order to recruit his health, which has suffered by the tropical climate.—Herr Flegel, who was preparing for a new expedition into the Benué districts, is also detained in Europe by ill health.—The Russian traveller, M. Piasecki, well known through his travels in China in 1874, is about to start on another exploring expedition to that country under the patronage of the Emperor of Russia and the Grand Duke Wladimir.

IN a recent number of the *Revue Scientifique* there is a long article by M. L. Simonin, on the geography of China. The area of the whole Empire of China is estimated at 11,574,356 square kilometres, *i.e.* the largest empire in the world next to that of Russia, which is 21,702, 230 square kilometres. China proper, however, is only 4,024, 690 square kilometres, *i.e.* two-fifths of Europe, seven times the size of France, and fifteen times that of Great Britain. With regard to the population of China it is not possible to give precise and absolutely trustworthy numbers, there being no proper official census in force in the Empire. The statistician of the Imperial Chinese Customs sets down the actual population of China at 250,000,000. A census drawn up in 1882 for fiscal purposes, and cited by the United States Minister in China, gives 255,000,000 as the number of the population. In the lower basin of the Yang-tse-Kiang as

many as 420 people are to be found crowded within the limits of one square kilometre. The total debt of the Government is reckoned at 266,000,000 francs, of which 214,000,000 francs have been contracted within the Empire itself, leaving only 52,000,000 francs of foreign debt. The army is composed of two large bodies: the Tartar army, including the Manchoos and the Mongols; and second, the Chinese army. The Tartar army, guarding Pekin, the frontiers, and the coast, comprises the army of Manchooria of 30,000 men, the Mongolian army of 20,000 men, the Turkestan army of 40,000, and lastly the army occupying the maritime provinces, numbering 100,000. The Chinese army proper is distributed throughout the eighteen provinces, and performs the functions of police in addition to its military duties. Its number ranges from 20,000 to 100,000 in each province, according to its population and its defensive requirements. The navy in 1879 was estimated to comprise fifty-six ships armed with 283 guns, and manned by 5860 marines. Since that date, however, the fleet has been largely developed.

L'Exploration states that the Geographical Society of Amsterdam is about to acquire the fac-simile of the most ancient map known, and which represents the Roman Empire as it was in the time of Augustus. It is formed of eleven folding maps, which make one large map 8½ metres in length. The original is in the Royal Library at Vienna, which purchased it in the sixteenth century from the estate of Conrad Peutinger of Augsburg, a circumstance which gave the map its name of *Tabula Peutingeriana*. Peutinger purchased it for 40 ducats. The original, which is dated 1265, was the work of a Dominican monk of Colmar.

THE deaths are announced of two Italian geographers and travellers, Eugenio Balbi and Carlo Guarmani. The former was the son of the celebrated Adrien Balbi, and was born at Florence in 1812. After several years' travel in Europe, he finally returned to Italy, where he devoted all his energy to the study of ethnography and geographical science. His principal works are: "Gea"; "I monumenti della geografia nell' evo medio e moderno"; "L'Italia nei suoi naturali confini." Guarmani had travelled widely, and in his last years was one of the correspondents of the geographical review of Milan, *L'Esploratore*.

THE Institute of Argentine Geography has decided to organise an expedition into the Andes of Patagonia. The explorers will leave Lake Nahuel-Huapi, and will then undertake a detailed investigation from a geographical point of view of the Argentine slope of the Andes, following it to the Straits of Magellan. The head of the expedition will be Capt. Moyano, who has been instructed to present a report to the Institute at the earliest possible date, indicating the plan of work, the instruments, and other objects necessary, as well as an approximate estimate of the expense. The Federal Government will be requested to grant the co-operation of the troops stationed on the frontiers of Limay, as well as to send a sloop-of-war to act where possible in concert with the expedition.

A TEACHING UNIVERSITY FOR LONDON

IN connection with our leading article this week we append the following Plan for Promoting a Teaching University for London, which was discussed at the meeting:—

A sub-committee was appointed on Monday, November 10, to draw up a plan, in accordance with the objects of the Association for promoting a Teaching University which are as follows:—(1) The organisation of University Teaching in and for London, in the form of a Teaching University, with Faculties of Arts, Science, Medicine, and Laws. (2) The association of University Examination with University Teaching, and direction of both by the same authorities. (3) The conferring of a substantive voice in the government of the University upon those engaged in the work of University Teaching and Examination. (4) Existing Institutions in London, of University rank, not to be abolished or ignored, but to be taken as the bases or component parts of the University, and either partially or completely incorporated, with the minimum of internal change. (5) An alliance to be established between the University and the Professional Corporations, the Council of Legal Education as representing the Inns of Court, and the Royal Colleges of Physicians and of Surgeons of London.

The Sub-Committee, consisting of Lord Reay, Chairman, Prof. John Marshall, F.R.S., Ex-P.R.C.S., Dr. W. M. Ord, F.R.C.P., Mr. F. Pollock, Barrister-at-Law, Mr. R. S. Poole, British Museum, Dr. P. H. Pye Smith, F.R.C.P., Prof. G. C.W. Warr, King's College, Prof. A. W. Williamson, University College, and Sir George Young, met and considered the subject of reference, and submitted the following proposed plan of a Teaching University for London for the consideration of the Committee, on Monday, the 15th inst.:—

(*a*) THE CONSTITUTION OF THE TEACHING UNIVERSITY.—To be founded on (1) the *Faculties* or Constituent Bodies; (2) a *Board of Studies* for each Faculty; (3) a Governing Body or *Council*.

(1) *The Council.*—To consist of Members representative of—

(*a*) The several Faculties. The proportion of representatives of the Faculties to the whole number of the Council to be at least one-third.

(*b*) The Senate of the University of London.

(*c*) The Council of Legal Education.

(*d*) The Royal Colleges of Physicians and of Surgeons.

(*e*) It should be a point for future consideration whether other Public Bodies should be directly represented on the Council, *e.g.*, the Authorities of the British Museum, of the Royal Academy and Royal Society, of the Incorporated Law Society, and of the Institute of Civil Engineers.

(*f*) Colleges and other Educational Institutions associated with the University. The amount of representation and the qualification for direct representation on the Council to be determined, in each case, having regard both to the nature and the amount of the educational work performed by the Associated Institution.

(*g*) Endowing Bodies, *e.g.*, the Crown, if the Teaching University should receive State endowment; the Corporation and Companies of the City of London, if they contribute to endow the University.

Representatives of Associated Institutions and Endowing Bodies not to exceed one-third of the whole number of places on the Council.

(2) *The Boards of Studies.*—To be elected by each Faculty. Some additional Members might be appointed by the Council. The Board to advise in all matters relating to the Faculty, and to exercise authority in such matters as are delegated to it by the Council. Facilities to be provided for joint meetings and action of two or more Boards of Studies when necessary. The Board to appoint some or all of the representatives of the Faculty upon the Council. If any are appointed by the Faculty direct, they should also be *ex officio* Members of the Board.

(3) *The Faculties.*—To consist for electing purposes of—

(*a*) Teachers: being Professors, Lecturers, or persons of equivalent standing, in the Colleges or Educational Institutions associated with the University.

(*b*) Examiners for the time being in the Teaching University and in the existing University.

(*c*) Additional Members, to be appointed by the Council, on the recommendation of the Board of Studies.

There might also be Honorary Members of Faculties, including Graduates in that Faculty, of the Teaching University; Members of Convocation of the existing University according to their Degrees; recipients of degrees *honoris causâ*, and so forth; such Honorary Members having the right to attend and vote only at a General Meeting of the Faculty, to be summoned on requisition when necessary.

(*b*) RELATIONS OF THE TEACHING UNIVERSITY WITH OTHER BODIES.—(1) *The Existing University.*—There might be one Chancellor, with two Vice-Chancellors, the Teaching University and existing University constituting one University in two departments. The Degrees might, if necessary, be distinguished by their designation in some suitable manner. The Senate of the existing University would remain unaltered, would be appointed as at present, and would control the present Examinations and confer Degrees, without interference. Convocation might accept the Graduates of the Teaching University as full Members. The Teaching University might, so far as is practicable, find a place of meeting at Burlington House, together with the existing University.

(2) *The Professional Corporations.*—Degrees in Law, Medicine, and Surgery to be recognised as qualifying *pro tanto* for Call to the Bar or for Licence to practise, the power of Calling to the Bar or of conferring Licences to practise being reserved to the existing Authorities. The previous Examinations of the Teaching University to receive recognition by those Authorities, such as is now given to the Examinations of existing Universities.

(3) *Colleges, Educational Institutions, Special Schools, and Institutions for Purposes of Research.*—Each Associated Institution to remain unaffected in any way, save in so far as it might be willing to adopt the recommendations of the University Council.

The School of Law of the four Inns of Court to be an Associated Institution, and its Professors and Examiners to be Members of the Faculty of Law, but without further direct representation on the Council than that already given to the Council of Legal Education.

The recognised Hospital Schools of London to be Associated Institutions, and their Professors and Lecturers to be Members of the Faculty of Medicine.

The direct representation of the Hospital Schools on the Council being difficult, owing to their number, it might be provided that they should all have one representative, at least, on the Board of Studies of the Medical Faculty.

Schools of Fine Art and Technical Schools employing Teachers, some of whom are not engaged in what can be called, strictly speaking, University work, if composing part of an Associated Institution, to be admissible as Special Schools of the University, and their principal Teachers to be Members of the appropriate Faculties.

Junior Schools forming part of Associated Institutions to be admissible similarly as Special Normal Schools, for the purpose of training Teachers.

Institutions for purposes of Research to be admissible as Special Schools, and their Principals or principal Members to be eligible as additional Members of the appropriate Faculty.

Educational Institutions, of which the work is either in kind or quantity insufficient to entitle them to rank as Associated Institutions, while at the same time partaking of a University character, to be similarly admissible as Special Schools.

(*c*) WORK OF THE TEACHING UNIVERSITY.—The Teaching University to obtain power to confer the usual Degrees, either by way of supplemental Charter to the University of London or otherwise, after such course of study and examination as may be determined on.

As means and opportunity will allow, the Teaching University to appoint Professors in the more advanced studies, and for purposes of original research.

The Council to negotiate with Associated Institutions for the increase of facilities for common attendance at lectures, laboratory work, and admission to Libraries and Museums, and for the concentration of teaching within one or more of such Institutions, or within the University itself, in such studies as may appear desirable.

The extent to which it may be found possible to blend the examinations of the Teaching University with those of the existing University, of the Professional Corporations, or of other Examining Bodies, to be determined hereafter, full liberty of action being reserved to the respective Authorities.

Professors, Lecturers, &c., who are Members of the Faculty, to have the title of "——— Professor, Lecturer, &c., of (or on) ——— " in the proposed University; the first blank denoting the College or Institution with which they are connected, preceded by the title (if any) by which their Chair or other office is known.

Students in Associated Institutions and Special Schools to be at liberty to become Undergraduates in the Teaching University, or to obtain Degrees as at present from the existing University.

Signed on behalf of the Sub-Committee,

REAY, *Chairman*

NATURE-DRAWING [1]

BEFORE explaining the objects aimed at in the new drawing classes proposed to be formed in University College School, to be called Nature-Drawing Classes, let us look back and note briefly what we have achieved up to the present time, and gather if we can from it what kind of foundation we have for the work we are about to do, and what our necessities are in order to secure success. Of the past I am able to speak with some authority, having been connected with the drawing classes in this school for nearly forty years. That we have achieved a very considerable success is proved by the high position these classes are known to hold as compared with similar classes in other public schools; also by the fact that every boy who has taken the "Trevelyan Goodall Art Scholarship" in the school and has competed for the Slade Scholarships in the Slade Schools of Fine Art in University College has, without an exception, succeeded in securing the object of his ambition, and in the case where two of our boys were competitors at the same time, they succeeded in carrying off both scholarships, and all in competition with students older than themselves.

Now it is evident that such remarkable success must rest on some very sound foundation. Though there is no doubt that our method of teaching may account in part for this, and in no small part, yet by far the larger part of the foundation of this success has been laid by the zeal, energy, and intelligence in teaching displayed by the assistant drawing-masters, and I desire frankly, and without any reservation whatever, not only to acknowledge their signal ability and their right to the merit due from the results, but also to acknowledge my own indebtedness to their loyalty in giving effect and unity to the method of teaching, without which our success could never have been secured. The teaching has hitherto ranged from the drawing of simple geometrical forms to the drawing of the figure from the antique, together with mechanical drawing, model drawing, and perspective. And now I have a word for the younger boys, who, sometimes, may find the repeated drawing of curved and other lines a little wearisome, but they may rest assured that they are doing valuable work, and acquiring an invaluable power, for it is mainly in the combination of these curved lines, in the perception of their grace, and the power to render them accurately and freely, that the expression of the most beautiful form, and even the recognition of it, at length becomes possible.

That curriculum in our public schools is best which has the greatest elasticity, and is not bound so closely within the four walls of precedent that it is deprived of the power to expand in any direction to meet the necessities of the times. That the teaching of drawing in our public schools has not advanced adequately to meet these necessities will be, in most cases, frankly recognised by the teachers themselves. But the fault does not lie at their door. It is the "governing bodies" of our public schools, and the outside public, who are to blame. The past low estimate of both alike as to the utility of drawing as a serious study has proved the detriment to its advance. Both have recognised in drawing little more than a sort of harmless amusement to keep children out of mischief when not otherwise employed. Both have been blind to the influence which the imitation of beautiful forms must needs have on the minds of the young, and, yet more, to the influence it must have in after life. A love for beautiful form goes far towards making a beautiful life. While due effect is given to the utilitarian side of education, the æsthetic side cannot be ignored, but through literature and art the æsthetic phase of the student's mind should be developed as widely as possible, and, as a help to this, Prof. Huxley has publicly stated his conviction that it should be made *absolutely necessary* for everybody for a longer or a shorter period to learn to draw, and that there is nobody who cannot be made to draw more or less well.

It is proposed to arrange the new nature-drawing classes under two broad divisions, namely, landscape-art and science-art. Let us deal first with the proposed study of landscape-art, and, in order to make the direction these studies are to take the more clear, it were as well to state the direction they are not to take. They are not to take their direction on the old lines of making, in a blind, ignorant way, copies from the flat to be "finished off" by the more or less facile pencil of the master, and sent home *as the work of the pupil* at the close of the term. The influence of such palpable dishonesty can only be bad, and the more bad because of the openness with which the fraud is committed. It may be asserted that no fraud is intended, but is not almost every child sensible that there is a very real fraud, to which he has been made a party without his consent, when he shows his drawings and is praised for work he is well aware is not his own? Moreover, do you think he does not recognise how frequently and *easily* the fraud succeeds? But enough; let us dismiss it—it is bad. In the "nature-drawing" classes in University College School, landscape-drawing from the flat will be used only to secure with the pencil and the brush that *technique* absolutely needful. Concurrently, lessons will be given in the shape of lectures on natural phenomena, towards inducing a close, intelligent observation of them, in the belief that a boy will not draw an object—a cloud or a tree from Nature—any the worse, or with any the less interest, because he knows something about it, some scientific facts concerning it. Drawing is a record

[1] An address by W. H. Fisk, in part delivered at University College School, Gower Street, London.

of thought as well as of observation, and the measure of thought, as applied to form, is in exact ratio to the knowledge of the causes of it, and the knowledge of them the measure of intelligent delight in observing and recording their results. Accept this as a fact—*art cannot be divorced from science*, for it is science which teaches us to see truly, and by art we render the truth we see. In representing the human figure, this has been a recognised fact for perhaps over two thousand years. They who have drawn the figure finely have been earnest students of anatomy. Yet the anatomy of landscape-forms has been persistently ignored by all but a very few. The recognition of the anatomy of landscape as an art-study is a very modern recognition indeed. Yet to see truly in order to render truly is of as paramount importance in the representation of landscape as in that of the figure. Individual form is a correlation of scientific facts, a knowledge of which enables us to understand its structure and to imitate its appearance with correctness. It is mainly with these that we have to do if we would represent a mountain, a tree, a cloud. It is true that all forms are modified by their environment—by a ceaseless struggle with the varying conditions by which they are surrounded—while the modifications are the result of scientific facts as the forms themselves are. So, if we would represent objects *truly*, science alone can be our guide; for it is science which teaches us to see truly, not through the medium of our fancy, but through the exercise of our intelligence. Thus, for example, in these nature-drawing classes, the structural forms of mountains of granite, downs of chalk, hills of limestone, will be presented and explained side by side with the forms as they at present exist, and which are the results of modifications produced by persistent disintegration and denudation owing to the action of rains, frosts, winds, glaciers, streams, &c., during vast lapses of time. So with the structural forms of trees and their environment—whether of Coniferæ on the limits of the snow line; or trees in a dense forest-growth or on the outskirts of a wood; within the Arctic Circle or in tropical regions; affected by climatic extremes, by drought or excessive moisture; the free access of light or through its deficiency; by the repeated action of winds mainly in one direction distorting the tree, or their influence in many giving a healthy stimulus to the circulation of the sap.[1] It is needless further to pursue the explanation of the plan it is proposed to carry out in landscape-art; enough has been explained to make clear the object in view and the method to be pursued. But the student must be prepared for many objections which will be raised: by painters careless of truth, and by some scientists who will insist on divorcing science from art because they feel their own minds chained by love of minute and beautiful detail, not thinking it possible for other minds to assert their freedom; by painters too lazy to enter the field of science, and who will assert that the mission of the artist is to represent what he sees, or rather what he fancies he sees, no matter whether he sees truly or falsely; or by people who, mistaking a certain deftness of handling for a true representation of natural phenomena, will exclaim, "Surely, if such landscape-art as we have has been sufficient in the past to secure public applause, will it not suffice to retain that applause for the art of the future? or are canvases to be crowded with illustrations of botany, geology, meteorology, bryology, and a host of other 'ologies,' and then to be called landscape-art?" Such talk as this is common enough, but it is sheer nonsense. To the true artist applause is a very small matter: he will not look to the market for the measure of his success, but he will gauge the quality of his own work, whether it be true or whether it be false. The one question with him is whether his picture is to be a painting of fancies which have no existence except in the idle mind of the ignorant painter, or is it to give us a representation of facts: in short, is it to be true or is it to be a sham? No true artist will ignore scientific truth, for he knows that it is next to impossible truly to generalise a multitude of like forms when he is ignorant of the special characteristics of any one individual form of the group. He will not ignore scientific truth, for that truth is the concrete foundation of all noble, all poetical art. There is one sovereign antidote to that poison so dreaded by some timid minds, viz. the chance that rigid illustration of scientific fact will dominate the work, and the antidote lies in the *individuality* of the artist. He will clothe all truth with the poetry of his own nature—with the force of his own character. He will be humbly and faithfully dependent on science for his *knowledge* of all form, but it will be on himself that he will depend for that *expression* of it through the medium of a psychical truth which is extra-scientific, and transcends in beauty the visible form of all natural truth, of which it is at once the sublimation and the epitome.

That division of the nature-drawing classes which I purpose to call science-art, presents in its plan a fourfold object. (1) To induce youths while yet at school to take up, seriously, some branch of natural science, with a view, eventually, to original investigation, and to afford them a power, both with pencil and brush, of accurately recording the results of their observation. (2) To supply that demand which Mr. Norman Lockyer informs us is now being made by scientific men, that students in science shall be able to draw. (3) To supply intelligent and artistic draftsmen for scientific purposes and for the illustrating of scientific works. (4) Mainly and especially to engender in young men, before they leave school to enter on the business of life, a love for the pursuit of scientific truth as being amongst the keenest amusements and the truest and most enduring pleasures of life.

In the ultimate purpose of any instruction lies the test of its future usefulness to the student and to society at large. The teaching of children has in it as much the making of the history of a nation as fighting battles and making laws, and earnest teaching is amongst the grandest employments of life, provided it be noble and useful and good. The teaching which is an inducement to a proper use of time goes far to create an environment which will be beneficial to maintenance and pleasure of life mentally and morally alike, and I know of no better use of time than that of scientific inquiry, which should be encouraged in all our public schools. So with drawing. By uniting it with the pursuit of science it will cease to be subject to that derogation it at present suffers through those who regulate, both within and without, the curriculum of our schools. But here in University College School the governing body is, as is well known, liberal to a fault, and the head master takes considerable interest in this new departure in the teaching of drawing.

Time will not permit me to dwell long on the plan to be adopted in the classes for science-art. At the commencement one or more scientific subjects will be selected. In connection with these the collecting of objects will be encouraged for purposes of investigation and illustration, but collecting for the mere sake of collecting will not be countenanced. Let us take entomology as an example. The student will capture the larvæ of a *few* moths or butterflies. Of each of these larvæ he will make careful coloured illustrations from time to time, according to the results of the changes they may undergo. Faithful drawings of the plants they are fed on will be required, also of any evidences of mimicry, defensive or otherwise. Further drawings will be required of the cocoons of such of the larvæ as form them, also of the chrysalis and of the fully developed insect (together with its eggs) and of whatever mimetic peculiarities it may present. From time to time original papers will be required stating minutely the observations made while the insect is being reared. After a time the more advanced pupils will be required to pursue their investigations into its anatomical structure and functions, with the use of the microscope.

A lucid mind will guide the hand to lucid drawing—the last is, as it were, a photograph of the first. The habit of clearly defining the object in the mind will lead to clear and definite work with the pencil. To students in science the securing of this power while at school will enable such to meet the requirements of science-teachers, and will be a source of economy of time and toil. This will form a branch of the teaching in the science-art classes. Moreover it will be the foundation for realising the third object in view, viz. to supply intelligent and artistic draftsmen for scientific purposes, and for illustrating scientific works. In this branch something more—much more—will be required of the pupil than faithful and intelligent exactness of outline of form. For instance, if the boy is drawing some vegetable form, he will be required to observe, closely, not only the peculiarities of the structure, but the *habit* which is the exemplar of the mind of the plant. Further he will be shown wherein the physical beauty of the plant resides, and wherein lies that beauty which is suggestive of some psychical power which, for a purpose beyond that of mere physical form, has tinted the butterfly's wing and the corolla of flowers fertilised by humming-birds. With such instruction there is no reason why the illustrations in works on natural history should not as far transcend most modern illustrations as these transcend those in a nurseryman's catalogue.

[1] Until the student can go direct to Nature he will draw and paint, in the higher classes, from water-colour studies which have been executed entirely out of doors, and of which a large number have been kindly lent by different artists.

But the chief aim of the science-art classes will be to encourage a pursuit of scientific truth for its own sake, not for the sake of displaying talent in making beautiful drawings to be praised for them, nor for the money to be got for them when drawn, but, *simply and only, for the sake of the* TRUTH, which will yield us pure and incessant pleasure all our lives, and engender a sincere reverence for the Creator who has clothed his truths in wrappages of beautiful blossoms, and pure crystals, and opalescent clouds; in wrappages, too, which appear mean and even ugly, but they are wrappages only; even sin—that, too, is a wrappage, and looks very ugly, and is very revolting, but it covers some good, some truth which lies hid in every human heart, if we will only seek to find it.

There is a vast amount of real art-power unutilised, and so wasted, in our public schools, through narrowness of purpose in the teaching. It has been so amongst ourselves, though what we have done we have done thoroughly. We have laid a sound foundation in close observation of beautiful form and acquisition of technical power in representing it. In adding to it these nature-drawing classes, we have nothing to unteach. The field of work is simply widened that the power may be the more effectually utilised with more pleasure and with greater profit to the student, not only while at school, but as a pursuit in after life, and possibly drawing many from pleasures which are ugly, coarse, bad, and fleeting. This is a view of nature-drawing which parents might think about not without profit to their children. The pursuit of scientific truth, whether in the shape of landscape-art or of science-art, is a very noble pursuit, a very lasting pleasure; besides which science and art cannot fail to be mutually benefited, mutually advanced, in the long run, by such a conjunction as this, for indeed art loses her right hand when divorced from science, and science loses her right hand when divorced from art.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

CAMBRIDGE.—The following have been elected to the General Board of Studies:—Mr. H. M. Taylor, by the Special Board for Mathematics; Prof. Liveing, by the Special Board for Physics and Chemistry; Dr. Vines, by the Special Board for Biology and Geology.

The election to the Cavendish Professorship of Experimental Physics will take place on December 22. The endowment of the professorship is 850*l.* a year.

The provision of 100 additional microscopes for the Biology Schools has been sanctioned, and a small charge will be made to students for their use.

Mr. C. T. Heycock, of King's College, has been approved as a Teacher of Chemistry, under the regulations for medical study.

The Syndicate for obtaining plans for a Geological Museum and Chemical Laboratory has been re-appointed.

Clare College offers to give scholarships of from 40*l.* to 60*l.* for Natural Science by examination, beginning March 19 next. The subjects will be Chemistry and Chemical Physics, Botany and Geology. A fortnight's notice will be required. Candidates, who must be under nineteen on the day of examination, must also pass in Elementary Latin, Greek, and Mathematics.

It is announced that in the next Fellowship election at St. John's College (November 2, 1885) regard will be paid to candidates' original dissertations or other writings, the candidates to be prepared to be examined in the subject-matter of the same. Candidates may also be examined in special subjects chosen by themselves, provided they give full and precise information regarding such subjects not later than June 1. The performance of the candidates in the University and other examinations will be regarded.

SCIENTIFIC SERIALS

Journal de Physique, October 1884.—The constitution and origin of group B in the solar spectrum, by M. L. Thollon (one plate).—On the colour of water, by M. J. L. Soret.—The effect of the electrical state of the surface of a liquid on the maximum vapour-tension of the liquid in contact with the surface, by M. R. Blondlot (one figure).—On the measurement of the maxima and minima electromotive forces in cells with a single electrolyte, by M. Emile Reynier (two figures).—Standard cell for the measurement of electromotive forces, by M. Emile Reynier.—On the chemical theory of accumulators, by M. Emile Reynier.—On the electrolysis of solid glass, by E. Warburg.

Journal of the Russian Physico-Chemical Society (Physical Section), vol. xv., 1883.—On an air-calorimeter, by N. Hesehus.—On a differential air-calorimeter, by W. Preobragenski.—On the critical temperature of isomerides and bodies belonging to the same homologous series, by A. Nadejdine.—New application of Carnot's theorem, by B. Sresnewsky.—On an algebraic transformation and its applications to mathematical physics, by by N. Slouginoff.—On the focal properties of diffracted rays, by M. Mertching.—On the peculiar properties of caoutchouc, by N. Hesehus.—Method of determining the mean tint of a multi-coloured surface, by Th. Petronchewsky.—On the cause and the law of the change of electrical resistance of selenium by the action of light, by N. Hesehus.—On the relation between the magnetic moment of a bundle of iron wire, its mass, and the diameter of the constituent wires, by P. Bakmetieff.—Note on organ-pipes, by P. Bakmetieff.—On some phenomena of permanent magnetism, by P. Bakmetieff.—On the luminous phenomena accompanying electrolysis, by N. Slouginoff.—On the theory of gratings traced on curved surfaces.

Royal Academy of Belgium, Nos. 9 and 10, 1884.—Among other communications is a paper by Dr. J. MacLeod describing some interesting particulars respecting the structure and homologies of the anterior intestine of the *Arachnides*. In the *Phalangides* he has found a gland of the same nature and function as the coxal glands recently described by Prof. E. Ray Lankester as belonging to the *Limules*, the *Scorpionides*, and the *Araneides tetrapneumones*. In the *culs-de-sac*, moreover, of the male gland of the *Trombidium holosericeum*, he has found, in all the individuals examined by him, ovules situated between the mother-cellules of the spermatozoides, though there was no question there of a functional hermaphroditism.—A paper by Émile de Borchgrave gives a graphic sketch of the history of Etienne Douchan, Emperor of Servia, and the Balkan Peninsula in the fourteenth century, and of the events which led up to the battle of Kossovo, the grave of the liberty and greatness of Servia.

Cincinnati Society of Natural History.—In the October *Journal* are two papers by U. P. James: one describing four new species of fossils from the Cincinnati group, the other treating of Conodonts and fossil annelid jaws.

SOCIETIES AND ACADEMIES

LONDON

Mathematical Society, December 11.—J. W. L. Glaisher, F.R.S., President, in the chair.—The Rev. T. C. Simmons, Christ's College, Brecon, and Mr. W. J. Ibbetson, Clare College, were elected members.—Mr. Tucker read a paper on a group of circles connected with the nine-point circle considered as the locus of the intersections of orthogonal Simson lines. If PL, PM, PN are the perpendiculars from any point of the circum-circle on the sides BC, CA, AB of ABC, then LMN is a Simson line: if POP' be a diameter, then the Simson line $L'M'N'$, corresponding to P', intersects LMN at right angles in a point Q, on the nine-point circle, which is also the inscribed circle of the tricusp, enveloped by the Simson lines. These properties were stated in a paper by Steiner ("Crelle," Band liii.). In the present paper points l, m, n are taken on PL, PM, PN, such that $Ll = K.PL$, $Mm = K.PM$, $Nn = K.PN$. It was shown that the lines lmn, $l'm'n'$ intersect at right angles on a system of circles whose centres lie on the line connecting the circum-centre and ortho-centre (H) of ABC, that the sets of Q points (as above) lie on another straight line through H: that the circles are inscribed in tricusps, the points of contact lying on three straight lines symmetrically situated and passing through H. In the special case of nul-radius, *i.e.* when the (K) circle becomes the ortho-centre, it was seen that the images of any point on the circum-circle with regard to the three sides lie on a straight line through H.—Mr. Tucker then read parts of a paper by Mr. R. A. Roberts, entitled "Notes on the Plane Unicursal Quartic."—Two posthumous notes by the late Dr. Spottiswoode, P.R.S., were communicated, viz. on quadratic transformations, and to find whether a (certain) quadratic transformation be possible.—The Treasurer (A. B

Kempe, F.R.S.) made a short communication as to the mode of proof of the well-known theorem that, if $A\,D\,B\,E\,C\,F\,A$ be a hexagon in a plane, and if $A\,B\,C$ be collinear and $D\,E\,F$ be also collinear, then the intersections of the opposite sides of the hexagon are also collinear.—Mr. G. Heppel stated the following property of the equation to a central conic, $ax^2 + 2hxy + by^2 + c = 0$, which he had not met with in the ordinary text-books. The co-ordinates being rectangular, then, in the case of the ellipse, if $\frac{h}{c}$ be $+^{ve}$, the major axis passes through the first quadrant; in the case of the hyperbola, if $\frac{h}{c}$ be $-^{ve}$, the transverse axis passes through that quadrant. This property is proved by supposing the equation transformed to $\frac{x^2}{p^2} \pm \frac{y^2}{q^2} = 1$, and then transforming back again, so as to make the equation identical with the original equation. The comparison of coefficients gives the above law.—The President communicated a result he has obtained in elliptic functions, which will appear in a forthcoming paper.

Zoological Society, December 2.—Dr. St. George Mivart, F.R.S., Vice-President, in the chair.—Col. Biddulph exhibited a stuffed specimen of the Wild Sheep of Cyprus (*Ovis ophion*), sent for presentation to the British Museum by Sir Robert Biddulph, the High Commissioner of Cyprus.—Col. Biddulph also exhibited three heads of the Wild Sheep of Beluchistan, named *Ovis blanfordi* by Mr. Hume, and drew attention to their similarity to *Ovis cycloceros* from the Salt Range, which led him to express doubts as to the distinctness of *Ovis blanfordi* as a species.—The Secretary called the attention of the meeting to the death, on July 5 last, of the Greater Vasa Parrot (*Coracopsis vasa*), presented to the Society by the late C. Telfair, Esq., in July 1830, which had thus passed fifty-four years in the Society's Gardens, and made some observations on a peculiar habit of this species.—A communication was read from the Rev. A. M. Norman and the Rev. T. R. R. Stebbing, containing an account of the first portion of the Crustacea Isopoda dredged during the expeditions of the *Porcupine*, *Lightning*, and *Valorous*. The memoir contained descriptions of the representatives of the three families Tanaidæ, Apseudidæ, and Anthuridæ obtained during the several expeditions. A great number of new forms, chiefly from deep water, including several genera (*Sphyraphus*, *Alsotanais*, and *Tanaella* among the Tanaidæ, and *Anthelura*, *Hyssura*, *Cyathura*, and *Calathura* among the Anthuridæ), were described.—Mr. G. E. Dobson, F.R.S., exhibited a diagram designed to illustrate the evolution of the Mammalia, after Huxley.—Prof. F. Jeffrey Bell read the fifth of his series of studies in Holothuroidea. The present paper gave some further information on the characters of the Cotton-Spinner (*Holothuria nigra*).—Mr. J. Bland Sutton read a paper on the parasphenoid, the vomer, and the palato-pterygoid arcade of the vertebrated skeleton. Mr. Sutton came to the conclusion that the parasphenoid of fishes was the homologue of the vomer of mammals.—Mr. G. A. Boulenger, F.Z.S., read some notes on the edible frogs introduced into England, which he referred to two forms—*Rana esculenta typica* of France and Belgium, and *Rana esculenta lessonæ* of Italy.—A communication was read from the Count T. Salvadori containing remarks on certain species of birds from Timor Laut.—A communication was read from Mr. E. P. Ramsay, C.M.Z.S., containing the description of a supposed new species of Flycatcher from New Guinea, proposed to be called *Rhipidura fallax*.—Mr. F. Day read the third of his papers on races and hybrids among the Salmonidæ. The author gave an account of how the salmon, which had been raised in fresh water at Howietown, had been artificially spawned; and pointed out that all the hybrids between the salmon and the trouts had proved sterile, while the hybrids between the trouts and the chars had proved fertile.

Geological Society, November 19.—Prof. T. G. Bonney, F.R.S., President, in the chair.—Nicol Brown, James Charles Chaplin, Herbert W. Hughes, and Rev. Samuel Pilling were elected Fellows; Prof. A. L. O. Descloizeaux, of Paris, a Foreign Member, and Prof. Hermann Credner, of Leipzig, a Foreign Correspondent of the Society.—The following communications were read:—Note on the resemblance of the upper molar teeth of an Eocene mammal (*Neoplagiaulax*, Lemoine) to those of *Tritylodon*, by Sir Richard Owen, K.C.B., F.R.S. In this paper the author referred to the genus *Neoplagiaulax*, described by M. Lemoine from the Eocene of Rheims, as presenting premolars so like those of the Mesozoic genus *Plagiaulax* as to have suggested the above name, while the true molars in the upper jaw resembled those of South African genus *Tritylodon* even more nearly than those of *Microlestes* and *Stereognathus*, with which the latter were compared. The lower molars of *Neoplagiaulax* have only two, instead of three, longitudinal series of tubercles; and the author suggested that this may have been the case also in *Tritylodon*; and that the detached molars, on which the genus *Microlestes* is founded, may also belong to the lower jaw.—On the discovery in one of the bone-caves of Creswell Crags of a portion of the upper jaw of *Elephas primigenius*, containing, *in situ*, the first and second milk-molars (right side), by A. T. Metcalfe, F.G.S. The specimen exhibited to the Society and now described was obtained from one of the Creswell bone-caves, before the commencement of their systematic exploration by a Committee of the British Association. The bone-caves are in the Lower Magnesian Limestone of the Permian, not far from the southern limit of that deposit near Nottingham. The locality was described, and it was shown that the ravine in which the caves occur has been cut in the limestone by the little river Wollen, which probably began by excavating a cavern the whole length of the ravine. The roof of this cavern must have fallen in, and the minor lateral caverns, in which bone-deposits are found, are now similarly being converted into side ravines. The fossil was found in "Pin-Hole Cave," the most westerly on the north or Derbyshire side of the ravine, about six inches below the base of the surface-soil, here four inches deep. The cave has been described in the Society's *Journal* (vol. xxxi. p. 679), by Rev. J. M. Mello, who in 1875 obtained from this spot bones of the Arctic fox (*Canis lagopus*). As the particular mammoth teeth (first and second milk-molars of the upper jaw) occurring in the fossil were wanting in the National Collection, the author has undertaken to present the specimen to the British (Natural History) Museum.—Notes on the remains of *Elephas primigenius*, from the Creswell bone-cave, by Sir R. Owen, K.C.B., F.R.S. The author noticed the various descriptions by Cuvier and himself of milk-molars of *Elephas primigenius*, and pointed out that all hitherto known were found detached. The present is the first known occurrence of the two earliest milk-molars *in situ*. The specimen discovered by Mr. Metcalfe is a portion of the fore part of the maxilla of a very young elephant with the teeth of the right side preserved, the corresponding teeth of the left side and their sockets having been broken away. Of the two teeth thus obtained descriptions and measurements were given. The first tooth is much worn, but only the anterior portion of the second has undergone wear, the two hindmost divisions of this tooth not having risen into use. It is shown that these first teeth of *E. primigenius* differ much less from the corresponding milk-molars of the Indian elephant than the later teeth do, the thickness of the constituent enamel-plates being but little less in proportion, and the principal distinction being the greater relative breadth of the second molar, especially towards the base of the crown.—On the stratigraphical position of the Lower and Middle Jurassic *Trigoniæ* of North Oxfordshire and adjacent districts, by Edwin A. Walford, F.G.S. The author spoke of the value of the *Trigoniæ* as stratigraphical guides, and of the wealth of the Oolitic deposits of North Oxfordshire in number of species as well as of individual forms. He alluded to the recent discovery by Northampton geologists of *Trigonia literata* and *T. pulchella* in the centre of their county. By the presence of certain *Trigoniæ* as well as of corals and bored stones he endeavoured to prove the extension of a stratum at the base of the *Clypeus*-grit at Fawler, as far as Hook Norton, also in North Oxfordshire, where the bulk of the Inferior Oolite was of an altogether different type. In Mr. Walford's list were nearly thirty species and varieties from the Bajocian beds. To the lower horizons there belonged but one local form, and no species of special stratigraphical value. The presence of a few other fossils supposed to be characteristic was the only evidence of beds below the zone of *Ammonites murchisoniæ*. Series C, which appeared to be of the age of the lower *Trigonia*-grit, had yielded the greater part of the *Trigoniæ* mentioned, several of them being peculiar to the horizon, whilst others were local species. The higher beds had yielded some apparently undescribed forms, whilst hitherto unrecorded species were quoted from the Great Oolite and Forest Marble. One species (*T. lycettii*) was described as new.

Chemical Society, December 4.—Dr. Perkin, F.R.S., President, in the chair.—The following papers were read:—

On calorimetric determinations of magnesium sulphate, by S. U. Pickering. The author finds that, when the ordinary heptahydrated salt is heated to 100°-130°, it retains about $1\frac{1}{9}$ molecule of water. This excess of one-ninth may be expelled by heating to 150°-160°, but, if this temperature be exceeded, some anhydrous salt is formed. The numbers obtained with the monohydrated salt were 12,131 cal.; with the anhydrous salt, 20,765 cal.—On condensation compounds of benzil with ethyl alcohol, by Miss M. E. Owens and Dr. F. R. Japp. By the protracted action of very dilute alcoholic potash upon benzil in the cold, the authors have prepared in large quantity a body, $C_{30}H_{24}O_4$, fusing at 200°-201°, and crystallising from alcohol with a molecule of alcohol of crystallisation. No acetyl derivative could be prepared. A second condensation-product, $C_{46}H_{34}O_4$, fusing at 232°, was also obtained.—Note on the solubility of certain salts in fused nitrate of soda, by F. B. Guthrie. The author has experimented with the sulphates, chromates, and carbonates of barium, strontium, calcium, and lead.—On certain derivatives of isodinaphthyl, by A. Staub and Watson Smith. The authors have endeavoured, by gentle oxidation of this body, to form the corresponding naphthoic acid. Cold strong nitric acid, however, produces a tetranitro body; dilute nitric acid in sealed tubes formed phthalic acid, and permanganate gave a similar result. Chromic acid in glacial acetic acid produced isodinaphthylquinone, a yellow amorphous powder melting at 250°-260°.

EDINBURGH

Mathematical Society, December 12.—Mr. A. J. G. Barclay, President, in the chair.—Mr. P. Alexander, Lady Margaret's College, Glasgow, contributed a paper on failing cases of Fourier's theorem, remarks on which were made both by Dr. Muir, who read the paper, and by Prof. Chrystal.—Dr. Muir gave a note on a function of two integral arguments; and Mr. A. Y. Fraser discussed the number of conditions determining geometrical figures.

DUBLIN

Experimental Science Association, November 19.—On Boakes's siphons of sulphur dioxide, by Prof. E. Reynolds, F.R.S.—Photometric measurement of lighthouse illumination, by T. Syle, University student.—On photometers made of paraffin, by J. Joly, B.E. This was an arrangement based on the remarkable difference of appearance presented by a piece of cracked paraffin about the plane of the crack, if placed in an unequally illuminated field. Two similar slabs of paraffin laid together on smooth faces show this effect very well. If the illumination about the plane of contact be brought to equality, the appearance of discontinuity vanishes. The close proximity of the fields to be compared confers great sensibility on the arrangement. The effect is due to the complete dispersion of the light in the translucent paraffin, thereby causing a large amount of it to be totally reflected at the plane of contact, across which, therefore, but little of the light received on either side passes.

PARIS

Academy of Sciences, December 8.—M. Rolland, President, in the chair.—Note on the photograph of a tornado taken by J. N. Robinson Howard last August in Dakota, United States, by M. Faye.—Final researches on antiseptic intravascular coagulation, by M. L. Gosselin.—Observations of Wolf's Comet made with the 8-inch equatorial at the Observatory of Bordeaux, by M. G. Rayet.—Observations of the same comet made with the meridian circle at the same observatory, by M. G. Rayet.—On the inversion of the abelian integrals, by M. Appell.—On a trigonometric formula of interpolation deduced from two formulas already established applicable to even and odd functions respectively, by M. G. Fouret.—On a generalisation of continuous fractions, by M. H. Poincaré.—On the integrals of certain functional equations, by M. G. Kœnigs.—Note on the numerical results required for the calculations of compressed gas manometers, by M. E. H. Amagat.—On the application of Ingenhonz and de Senarmont's processes to the measurement of the relative thermic conductibilities of different substances considered as isotropic, by M. Ed. Jannettaz.—On some practical processes for examining the luminous spectra of bodies to which the method of Lecoq de Boisbaudran is inapplicable, by M. Eug. Demarçay.—On ferrocyanhydric acid and the nitroprussiates, by MM. A. Étard and G. Bémont.—On the optic inactivity of the cellulose of cotton, and on the rotatory power of the gun-cotton of photography, by M. A. Béchamp.—Chemical analysis of the so-called "*porte-graine*" beetroot in the second year of its growth, by M. H. Leplay.—On the inertia of the retinal apparatus and its variations according to the exciting colours, by M. Aug. Charpentier. From experiments made during the last few years, the author concludes that the inertia increases with the refrangibility of the stimulating rays. Hence more light is absorbed or used up in producing the luminous sensation for the blue than for the green rays, for the green than for the yellow, and so on to the red. He further shows that any increase of intensity for any given colour requires all the more light in proportion to its greater refrangibility.—On the disease of the vine known by the name of *pourridié*, by MM. G. Foex and P. Viala. This disease, which is common in the South of France, and especially in Provence and Roussillon, is attributed to a species of fungus first observed by R. Hartig, and by him named *Dematophora necatrix*.—On the presence of the middle carboniferous measures in Anjou, by M. Ed. Bureau.—The results are given of a geological survey of this district undertaken during the present year by the author and his brother, the Director of the Natural History Museum of Nantes.—Tables of atmospheric movements between the parallels of latitude 30° S. and 80° N. for November 20, 1879, and January 1, 1880, based on the barometric charts prepared by M. Léon Tisserenc de Bort, by M. Poincaré.

VIENNA

Imperial Academy of Sciences, November 13.—Researches into the intimate structure of striated muscle-fibre, by A. Rollett.—Determination of the orbit of the planet *Adria*, by E. von Hœrdtl.—Remarks on the physical constitution of the atmosphere, by N. Herz.—The botanical results of Polack's expeditions to Persia in the year 1882, by O. Stapf.—Report on the plants collected by F. Luschan in Lycia and on the Nimroud Dagh, by the same.

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