THURSDAY, DECEMBER 4, 1873

DR. MEYER'S EXPEDITION TO NEW GUINEA

BEFORE giving to the readers of NATURE a brief account of my own voyage to New Guinea, from which island I have just returned, I shall say a few words about some other expeditions to this "far-east" and interesting island, undertaken within the last two years by various governments and private individuals.

In 1871 the Dutch Government sent out a steamer and specially appointed officials, to circumnavigate the entire island of New Guinea, land from time to time, and take formal possession of those parts of the country which did not yet belong to the Dutch. It is known that this nation has hitherto had only a certain right over the western part of New Guinea as far as 141° E.; and before going farther the expedition had to erect sign-posts in the name of the Dutch Government at different parts of western New Guinea. But this first expedition did not attain its end; a few posts were set on the north coast, the farthest east being on Humboldt Bay, on the frontier of the Dutch territory; the expedition tried to go still farther east, but was obliged to return in a very bad condition, without having fulfilled its task.

In 1872 the Dutch sent out a second expedition in a small steamer for the same purpose; but this one did not succeed in going even so far east as the first, and was likewise obliged to return, after a very short time, without any result.

It is now proposed to try another expedition on a larger scale in 1874, which will go first through Torres Strait to the east, and afterwards, along the north coast, to the west; but I am not sure that this plan will be carried out.

In 1870 some Italians, under the guidance of M. Cerruti, who had been several times in New Guinea before (1861, 1865, and 1866), visited in a little schooner a part of the south-west coast, for the purpose of looking out for a convict settlement for their Government, and explored chiefly the straits between the island of Salwatty and the mainland. They were attacked in MacCluer Gulf, and the combat that took place was much spoken of in Dutch India during my sojourn there.

In 1872 two Italian naturalists, M. Beccari and M. d'Albertis, endeavoured to visit the mainland of New Guinea at a place on the south-west coast, called Utanate, which had been previously visited by the Dutch; but they could not reach it, on account of currents and winds. They remained for some time longer to the westward of the south-west coast and at Sorong, between the island of Salwatty and the mainland (where in the beginning of 1873 eighteen Europeans from an Australian pearlfisher were murdered by the Papooas*), then proceeded to Dorey, in the north, and made a station on the Arfak Mountains. They returned in November 1872, an Italian man-of-war being sent by their Government to look after them.

During the same time a Russian traveller, Mr. Maclay, had been on the north-west coast of New Guinea, in Astrolabe Bay. He was brought thither, and fetched away after more than a year's stay, by a Russian man-of-war; his plan to cross the mainland of New Guinea in any direction could not be effected, as was to be foreseen by those who know something about the special difficulties of travelling in New Guinea. He only moved about the district extending some miles round his station. Before I started on my expedition I met, in the beginning of this year, in Ternate (Molukkas Islands), the Russian man-of-war, coming back from New Guinea. Although she had only stayed in Astrolabe Bay for five days to take in water and wood, still, two months later, more than eighty of the ship's officers and crew were attacked by fever.

Finally, the news which reached Europe from Australia in respect to New Guinea, and which had already in 1871 made the Dutch send a man-of-war round that continent, to inspect how far the plans of the "New Guinea Prospecting Association" were ripening, this news, as well as the end of the expedition of this Association in 1872, are better known in England than the other undertakings which I have roughly sketched above.

The proposed and partly effected settlement of missionaries of the London Missionary Society on the islands of Torres Strait, and that proposed to be made on the south coast of New Guinea itself, are likewise known.

Whether the news, published in an Australian paper, that the English had taken possession of the extreme south-east shore of New Guinea, be true or not, I am not able to say. But from what has been said it may be concluded that the eyes of civilised nations are now fixed more on New Guinea than ever, and that results will be sure to follow. What these results may be, and what prospects all these exertions may present in respect to the character of the country and its inhabitants, I will not take into consideration now, but proceed to a sketch of my own voyage.

On my previous travels, which went as far as the Island of Celebes and the Philippine Islands, I had gathered sufficient information to know which would be the easiest way to reach New Guinea, and how to find the best place for a station. I was aware of the impossibility of penetrating into the interior of the larger part of this large continent, if my expedition were not of much larger dimensions, and if it could not command much ampler means than are available to a private person like myself, and chiefly if it would not lose its character of a natural history expedition, and become solely a geographical exploration. On another occasion I shall show how such a geographical expedition through New Guinea could be started by one individual or by a company of travellers, and to what parts it would be most advantageous to proceed at first. The peculiarities of the country and the natives are such, that there are even more difficulties for travellers here than there are in Australia, where the best-fitted-out expeditions and the most able and courageous men have failed. In New Guinea it is even a question, whether the scientific or practical results are likely to be at all equal to the expenditure and the great danger connected with such an undertaking.

Being obliged, therefore, to resign the eastern and larger half of the island, I had to choose for a starting-point only between the south-west coast, from opposite the Aru Islands to Salwatty, and the coasts of Geelvinks Bay. I preferred the latter, for several strong reasons which weighed against the south-west coast, and

* I write Papooas, and not Papuas, because the Malays pronounce the word "Papooa," and not "Papua."

in favour of Geelvinks Bay; among others were the unhealthiness of the swampy shores of the south-west coast, the fact that the natives of these parts have been more influenced by Malay traders for centuries than those of the northern regions, and therefore are less original, and that the south-west coast has been visited oftener by Europeans.

In consequence of the time consumed in making all necessary preparations, I only reached New Guinea in the beginning of March of this year, and anchored the little schooner, which I had hired in Ternate—(I preferred this place as a starting-point to Amboina)—in the harbour of Dorey, in the north-west corner of Geelvinks Bay, the only part of all New Guinea where any Europeans, German and Dutch missionaries, are settled. With me, and in my service on board the ship, over which I had full disposal, were, besides about fifteen Malay sailors and a Malay captain, twenty natives from different parts of the Malay Archipelago.

Dorey has been described, among others, by Mr. Wallace, but he has, in my opinion, not given a correct impression of the natives of the surrounding hills and mountains, separating them in some way from the inhabitants of the coast, as smaller, uglier, not mop-headed, &c. As I afterwards spent a long time among the natives of the Arfak Mountains, near Dorey, and the inhabitants of the different parts of the coast of Geelvinks Bay, the islands in the north of it, and the interior of this whole north-west part of New Guinea, I may state, that there is no generic difference at all between the Papooas of the mountains and the Papooas of the coast—except such differences as we find everywhere between the highlanders and coast inhabitants of the same race.

The changing of the West into the East Monsoon, to be expected in April, obliged me to visit first the islands in the north of Geelvinks Bay, if I wished to visit them at all; and therefore, after a three days' stay at Dorey and neighbourhood, I immediately started for Mafoor, a smaller island, only about sixty miles from Dorey. It took me more than forty-eight hours to reach it. Mafoor offered me nothing particular, besides its zoological productions; it is only interesting, for having been at an earlier period the chief seat of the Mafoor tribe, which now inhabits all the coasts of the western part of Geelvinks Bay.

The island of Mysore (Willem Schouten's island), the furthest north and a larger one, was far more important for my purposes. The natives were at first of a hostile disposition, but we soon became friends, and I spent here a most interesting time, in consequence of the results of my collections and what I saw of the Papooas, wild and nearly unmodified tribes, with all the virtues and vices of such. I commenced to make a collection of Papooan skulls here, in which at last I was so successful, that I hope to be able now, by means of my large materials, to trace at least the limits of the variation which the skull of this race undergoes, and finally to fix the type of the Papooan skull,—important questions, which craniology can solve.

On Mysore, Birds of Paradise, as well as the Kasuary, are unknown; but it as well as the large island of Jobie, which I now visited, is the home of the fine Crown pigeon (*Goura victoriæ*). This beautiful bird occurs in such quantities, that it furnished us with our daily meals during nearly the whole of our stay on Mysore and Jobie. The flesh is most tender and delicate, preferable to any fowl I know of.

Jobie has for long had the reputation of being the home of many species of rare birds of Paradise; I am sorry to be obliged to rob it of this glory. I only got *Paradisea papuana* (but with more splendid, deeper orange and longer side feathers than from the mainland of New Guinea), *P. regia* and *Diphyllodes speciosa*. *P. papuana* is not rare, but very local, so that one may hunt for weeks in the mountains, without finding a single specimen (females and young males are seen and heard much oftener than males in their plumage); but if once a tree is found where they feed and "dance," a lot of them can be got together. *P. regia* is rare, and *D. speciosa* very difficult to get here.

I am sure that no other species of Birds of Paradise come from Jobie, as no other species are in the hands of the Papooan traders. I am convinced of this, because I stayed a long time at the chief place of the island, Ansus, a very populous settlement, where I saw and heard everything; more than two thousand Papooas are living here together, all in those large, curious houses, standing entirely on the water. But other species of Birds of Paradise which I showed (I had obtained some in Ternate and Dorey on my way), were unknown even to the inhabitants here, except to those who had been on the mainland. I mention this fact, notwithstanding that I had not the intention of giving any zoological details in this account, because it may be seen, how erroneous it was to give credit to the natives of New Guinea, who pretended that some rare birds of Paradise came from Jobie, certainly with the purpose of withdrawing attention from their own country, where these birds are to be found.

In general the fauna of Jobie is very poor, as well in respect to different species as to the mass of individuals of one species.

The inhabitants of the mountainous parts of Jobie are known to be cannibals, as well as the tribe of the Karoans, in the mountains of the north coast, between Amberbaki and the two small islands Amsterdam and Middelburg,* and the tribe of the Tarúngarays on the east coast of Geelvinks Bay. Here on Jobie, as everywhere on New Guinea, the coast Papooas are in perpetual war with the mountain tribes. Perhaps because some individuals of the latter believed us to be more friendly to the inhabitants of Ansus than to themselves, or that they required no special reason for fighting, once without any warning or provocation we were attacked with spears and arrows; but I afterwards took such precautions and frightened them to such a degree, that during our whole stay here we experienced nothing further disagreeable. The Papooas of Jobie have everywhere the bad reputation of being wild and quarrelsome.

After having left Jobie, from which I set ou with a heavy heart—I should have liked to remain longer—I went as

* When back at Dorey in July, the natives here were very much frightened, because the Karoans near Amberbaki had just robbed and destroyed a trading vessel, and killed or enslaved the crew.

far to the east as the river Amberno, in fact to the north-east corner of Geelvinks Bay, and then shipped to the south-west, along the coast, landing and hunting from time to time, and trying to find a favourable place for a longer stay, and a spot from which it would be possible for me to penetrate into the interior, or to cross the island.

I did not succeed till I reached the south point of the bay. Here I found a little tribe of Papooas, who treated me from the beginning to the end in the most friendly way. On this account, and because I enjoyed a very favourable hunting-ground (immediately after going ashore I got four different species of birds of Paradise), I remained here for some weeks. Shortly after having anchored, even the young girls came on board the ship together with the men, and remained there for hours, whereas, in other parts, the women generally are very shy and keep aloof.

Seeing that I could trust the natives here, I tried to carry out my project of crossing the country to the coast opposite the Aru Islands. But even if I had not come so far, for reasons which it would be out of place to give in this brief account of my journey, I got some interesting additions to our geographical knowledge,* and was very much satisfied with my zoological collections.

But I would not give up my plan of crossing New Guinea, and therefore proceeded near the coast to the north-west, looking out everywhere for a convenient starting-point, and gathering every possible information from the natives. But the island was still too broad here; the Papooas knew nothing of the opposite coast, as they do not migrate so far.

The natives of these western coasts of Geelvinks Bay are all afraid of the Wandamman tribes, whereas those of the eastern coasts are afraid of the Waropin tribes; but generally the vast country here is very poorly populated, there being few settlements, and these few small ones.

The point where I crossed the island at last into MacCluer Gulf of the south-west coast was situated 134° 18′ E., 20° 38′ S. I went first to the north-west, and then, after having passed several mountain chains (2,000 ft.), to the west, down a fine river called the Jakati, through the country of Onim. It was, perhaps, lucky for me that I could only get a very small native prau here, else I would have proceeded farther west by sea, (the swamps render it impossible to go by land), and possibly encountered dangers from the natives of the MacCluer Gulf, who have not the best reputation, and who certainly would have felt inclined to revenge their countrymen, killed by the Italian Cerruti and his company, some years ago.

I need not say that this journey from one side of New Guinea to the other has never been made before; and I should hardly myself attribute any importance to the fact, were it not for the reason that till then we did not know exactly whether there existed a communication by water from Geelvinks Bay to MacCluer Gulf or not. We may be convinced now that it does not exist.

From Geelvinks Bay I tried to ascend the Arfak Mountains from the south, but did not succeed, because I ran short of provisions. The country seemed uninhabited, or, without Papooan guides as I was, and with only some of my Malay companions, I missed the few native houses and small plantations in the neighbourhood, scattered here and there, so that it was not advisable to go too far into the country. Besides, I did not find in the forests on the southern slopes of the Arfak Mountains those gems of the bird-world which I hoped to find, and therefore left these regions and penetrated from the north with better success. It will be interesting for English ornithologists to learn that I succeeded in finding here (3,000—6,000 ft.) all the known Birds of Paradise of New Guinea (except the species from the islands), besides a new one, and a quantity of other most curious and rare specimens, the ornis of the mountains being quite different from that of the seashore. But here also, as on the whole of New Guinea, I was astonished to see that the fauna generally is not rich. The forms found in the country certainly are curious and characteristic, but, in comparison with the enormous mass of forest, they are everywhere very scarce, and it is an exception to find a hunting-ground where much is to be got in a short space of time. It is the same in New Guinea as I found it in Celebes, where more of the life of nature is to be seen and heard near the seashore and the settlements than in silent virgin forests.

I hope that now, since the interior of New Guinea is opened, at least as the way is known how to penetrate into one part of it, other naturalists will soon succeed in reaping more important results than it was my lot to obtain.

ADOLF BERNHARD MEYER

* The geographical part of my expedition will be published very soon, accompanied by a chart, in Petermann's *Mittheilungen*.

MICROSCOPIC PETROGRAPHY

Mikroskopische Physiographie der petrographisch wichtigen Mineralien ein Hülfsbuch, bei mikroskopischen Gesteinstudien. H. Rosenbusch. With 102 woodcuts and ten coloured plates. (Stuttgart.)

SINCE we last called attention to this subject in the columns of NATURE it has been making steady progress, chiefly among our German, that is, of course, German-speaking, brethren of the hammer and lens. The various serials which treat of Geology and Mineralogy bear witness to this progress, and to the wonderful activity of some of the workers, such as our good friends Zirkel and Tschermak, to whom it is so largely due. And now here comes a goodly octavo of some four hundred pages as a further contribution to our knowledge, and a fresh proof of the strong hold which the microscopic study of minerals and rocks has taken of the German geognostical mind. This activity need not be matter for wonder when one considers the chaos into which matters petrographical had got even in Germany. Those who studied rocks in that country had become a sort of bound thralls to chemists and chemical analysis. They dared not trust their eyes to discriminate the differences of species and varieties. The specimens must be handed over to the laboratory, and on the judgment thence obtained depended the names by which the compounds should be known thenceforward throughout Christendom. By this means, as the composition of a rock often differs considerably in different, and even in closely-adjoining, parts—variations resulting partly from original discrepancies, and partly from internal changes due to the subsequent infiltration of water or other metamorphic influences—it was not difficult to make out half-a-dozen distinct varieties of rock from the same mass and even from the same quarry. And so analysis of rocks grew and multiplied, chemists became more and more nice in their discrimination of the veriest fractions of a per cent., petrography seemed in a fair way of being annexed as a dependent province of chemistry, and the petrographers, who ought to have been geologists, and to have set themselves strenuously to find out what had been the history of the rocks as parts of the architecture of the globe, came gradually to accustom themselves to the notion that, after all, it was really true that rocks were merely so many chemical compounds to be analysed and labelled accordingly.

In the midst of the darkness wherein the poor petrographers ticketed their specimens, carefully arranged their cabinets, and elaborated their dreary treatises, there fell among them (not from heaven, but from the hands of a worthy citizen of Sheffield) a microscope and a few glass slides, with a description of what could be done therewith. Eyes which had seen no light for so long could not at first make anything of the apparition, but after a few years it began to take shape before them; and now the microscope promises to do as much in comparison for mineralogy and petrography as it has done for the biological sciences.

From town to town this new light has spread, or rather rushed, all over Germany. There is now a sort of neck-and-neck race who will make the most slices of rocks and minerals. A cutting or rubbing-machine and a microscope have become as necessary implements as a hammer or a lens. Every month brings to light some new "mikromineralogische" contribution, insomuch that if the fever lasts we shall ere long be as over-weighted with microscopic analysis as we used to be with chemical. Both are excellent and necessary, and yet we may be allowed to believe that neither singly nor together do they disclose to us anything like the whole history of the rocks, and that they cannot by themselves yield a sufficiently broad foundation for a truly philosophical classification in petrography.

The advantages of microscopic analysis applied to rocks are so many and obvious that we cannot be surprised that they should have been so widely recognised and put in practice. This method of investigation throws a direct light upon the construction of rocks in a way which chemical analysis can never do. Moreover, it is easily adopted. Anybody can make microscopic sections, and with due care and experience may become a skilful analyst. And then this mode of research is so cheap. Even if the observer does not care to give the trouble and time necessary for the construction of his own sections, he can get them made for him at small cost. And once in possession of them and his microscope, he obtains his results at once. No need to wait for days upon a solution, or to weigh and re-weigh his precipitates.

It is plain that as rocks are composed of aggregates of minerals in many various combinations, the first preliminary step in our investigation of their minute structure should be devoted to the study of the microscopic character of the minerals which compose them. We must know how these minerals are built up in themselves before we can adequately comprehend the manner in which they are mingled together to form rocks. Besides, in a crystalline rock, such, for example, as basalt, the component minerals are crystallised on so minute a scale, and often so imperfectly, that their ordinary and characteristic peculiarities may be so veiled that, unless from previous experience, we could not with certainty recognise them. Hence every student who sets himself, microscope in hand, to find out how the materials of the rocky crust of the earth have been put together, ought unquestionably to begin the search by accustoming his eye to the variations which the simple minerals present when viewed in different positions under a strong magnifying power. It will not be necessary for him to cut slices of every known mineral. He will have done enough for his immediate purpose if he has sliced in all directions, and examined with polariscope and otherwise the comparatively few simple minerals which are of prime importance, as those of which most of the visible rocks of the globe have been formed.

A text-book which will guide him in this most interesting and important research has never hitherto appeared. Descriptions of the methods to be employed in the preparation of translucent sections have been published both in this country and in Germany. Indeed, it was Nicol, of Edinburgh, who, besides giving us the prism named after him, invented and made known more than forty years ago this most ingenious method of investigation. Abundant notices have also been published during the last dozen years, chiefly in Germany, regarding the microscopic characters of many minerals and rocks, so that a student who had time and opportunity to consult this very scattered literature, might gain amply sufficient knowledge to start him in his research. But none the less has a general text-book been required to save such needless expenditure of time, and to give the student those practical hints which he is not likely to meet with in mere scientific communications on special subjects. It is this want which Mr. Rosenbusch endeavours to supply in the volume now before us.

From his preface we gather that living at Freiburg he caught the microscopic fever, and has had it for a number of years. Anxious to communicate the infection as safely and effectually as possible to the younger mineralogists, he has compiled a text-book which ought to serve its purpose well. It is well arranged, neatly printed, excellently illustrated, and cheap. After some introductory pages which skim over the history of his subject, the author proceeds, in the first or general part of his treatise, to give the student directions how to cut and prepare his slices of mineral or rock for microscopic examination. Then, having the slices prepared, he shows how they are to be used, and what may be looked for in them. With characteristic German completeness he speaks of the general morphological peculiarities of minerals crystallised and amorphous, and shows how singular and varied are the anomalies in internal structure revealed by the microscope even in what seem to be the most regularly built crystals. The optical properties of minerals are discanted upon with a fulness perhaps hardly in keeping with the other parts of the book, but the importance of this branch of the subject, particularly in reference to the analysis by means of polarised light, may well be pleaded in excuse by the author. The third section of the general descrip tion of minerals deals with their chemical peculiarities. It occupies not quite four pages, and has evidently been inserted for the sake of completeness, that the learner, even though specially intent upon microscopic work, should not be left wholly in the dark as to what he can accomplish himself in the way of chemical analysis.

The second and by much the more important and useful part of the treatise deals with the microscopic characters of minerals, and more particularly of those which enter largely into the composition of crystalline rocks. Considerably over a hundred minerals are treated in this way, and these, of course, include all those which are of prime consequence to the petrographer. For example, the felspars, augite, hornblende, calcite, quartz, pyrite, and other common ingredients of rocks are fully described. The author has worked hard at the subject himself, though he has not hitherto published much. One excellent feature of his volume is the full references which he gives to the papers of previous writers on the same subject. Not only at the beginning of the description of each mineral does he quote, in legible print, the titles of the papers in which information about the microscopic characters of that mineral may be found, but at the end of the volume he inserts a long alphabetical list of authors, with the names and dates of their papers. This is a most welcome boon to all those who, especially in our own country, have the courage to attack the voluminous, but hitherto hardly known or accessible literature of the subject. Two sorts of illustrations are given—woodcuts and coloured plates. Of the former rather more than 100 occur, mostly illustrative of the crystalline forms or optical characters of the minerals. They do not call for special remark, except that they might with advantage have been more numerously inserted to explain the internal peculiarities of some of the numerous species described. The coloured plates are singularly effective. Ten in number, they contain sixty figures of the microscopic structure of upwards of thirty more or less common minerals. We have seen nothing so good since Vogelsang's large and admirable drawings published six years ago at Bonn. It appears that it was originally intended to have included more plates, but that the cost proved so great that the number had to be restricted to ten. This, no doubt, is the reason why some not very important minerals have a place on the plates, while others of greater consequence have been left out.

This volume, even had it been less painstaking than it is, would have deserved commendation as an introduction to a study for which no text-book at all previously existed. But, as its author frankly acknowledges, it will not and is not intended to supply the place of actual personal work—"he who would learn microscopic mineralogy must to the cutting-lathe and the microscope." The greater the number of observers who can be induced to betake themselves to this pursuit, the sooner may we hope for some definite and broad well-established results. At present the work accomplished, most excellent and praiseworthy though it be, belongs rather to the hewing-of-wood and drawing-of-water order. The facts are weekly accumulating out of which, in the end, a flood of light will unquestionably be cast upon the genesis of rocks, and consequently upon the history of the earth itself. All honour, therefore, to the enthusiastic workmen by whom this labour is so cheerfully and actively undertaken, and none the less to Mr. Rosenbusch for publishing a most useful volume, which will, no doubt, increase their numbers.

OUR BOOK SHELF

Solid Geometry and Conic Sections, with Appendices on Transversals, and Harmonic Division, for the Use of Schools. By J. M. Wilson, M.A. Second Edition. (Macmillan and Co., 1873.)

Elementary Geometry, Books i. ii. iii., following the "Syllabus of Geometry," prepared by the Geometrical Association. By J. M. Wilson, M.A. Third Edition. (Same publishers, 1873.)

THE portions of the title-pages we have above given sufficiently indicate the scope of the two works under review and the measure of acceptance they have met with. As we have already given an account of the former work it will not be necessary to give any detailed account of it now. It has been considerably improved by the addition of some eighteen pages of new matter, consisting of a slight rearrangement of Section I., which treats of planes, the addition of a section (IV.) on the sphere, which is almost entirely new to the work, and some slight changes in the articles on the Ellipse and Hyperbola. The result is a close approximation to the views we expressed in our previous notice, and the book can be recommended as an excellent, if not the only English, treatise suited to the requirements of candidates for the first B.A. Pass Examination of the London University. We point out an obvious slip of *inscribed* for *circumscribed* circles, on p. 55; in the fifth paragraph, p. 56, all the A's but one should be accented; the last exercise, on p. 68, is misplaced, and repeated in its proper place, as Exercise 29 on p. 71; other minor slips can be easily corrected.

The "Elementary Geometry" is to our mind a vast improvement upon the first edition; the changes are all, we believe, in the right direction. We never took kindly to that first edition; the most confirmed euclidophilist must be led by a perusal of this to a more favourable view of the aims of anti-euclidean agitators. Seeing that the aim of teachers of both parties, if they are in earnest, should be the *improvement* of geometrical teaching, we trust that neither party will lose sight of this high mark through intervening clouds of dust raised on irrelevant grounds.

The "get-up" of both books is excellent, the printing of the "Elementary Geometry" most accurate (we have detected but one or two slight errors). We wish to add a closing remark on this subject of *errata*: we consider that an author is bound to bestow every care in this matter, and it is with regret that we find some works of recent date have been brought out, it is reasonable to suppose, in such haste to meet a possible demand for them that they may be said to teem with mistakes. This entails great waste of time and trial of patience upon junior students and appears to us unfair treatment. R. T.

LETTERS TO THE EDITOR

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

The Southern Uplands of Scotland

To the able articles on this subject contributed to your pages by Prof. Harkness, I should like to be permitted to make an addition. He has referred to some opinions and observations of mine, but I am anxious that it should be generally known to what an extent the results obtained by the Geological Survey are due to the zeal and ability of my colleagues. Thus, Mr. R. L. Jack has the merit of detecting and tracing the Caradoc basin of the Leadhills, and of working out the structure of that region which has been of so much service in the subsequent progress of the Survey. Mr. John Horne has carried the lines far into Galloway, and Mr. D. R. Irvine has traced them across a great part of Wigtownshire. Mr. H. Skae has mapped them across Dumfriesshire into Selkirkshire, while Mr. B. N. Peach, besides doing excellent service in the west, is now running them across the rest of the country towards the sea on the east.

Allow me also on the part of my colleagues, as well as for myself, to take advantage of this opportunity to thank Prof. Harkness for his most valuable and welcome papers, and to express our gratification that the labours of the Survey should have found so courteous an exponent, and one whose knowledge of the country which we have mapped is so minute and extensive.

ARCH. GEIKIE

The Huemul

IN Vol. viii. p. 253 of your valuable journal, I find it noticed that the Chilian Exploring Expedition has taken a specimen of the Huemul, an animal which had altogether been lost sight of, and first described by Molina under the name of *Equus bisulcus*. This notice is not correct, as the animal has been described already in 1846 by Messrs. Gray and Gervais, in the *Annales der scient. natur.* iii. Ser. Tom. v. page 91, under the name of *Cervus chilensis*, and compared with *C. antisiensis* of D'Orbigny, as the species most nearly allied to the Huemul or Guemul or Guamel, different names for the same animal in different parts of the country. This first description was repeated the following year in the "Historia fisica y Politica de Chile," Zoology, vol. i. page 159, and accompanied by the figure of the animal (pl. 10, and its skull pl. 11), from the only known specimen of a young male of half-grown size, brought to Paris by Mr. Gay. On the same specimen Mr. Pucheran has founded his description in his valuable monograph of the genus Cervus, published in the *Archives du Museum*, vol. vi. page 965 (1862), and from these two descriptions Mr. A. Warner has given a combined extract in his "Saugethiere," &c. Tom. v. (supplement), page 382, under the same name of *Cervus chilensis*. Meanwhile Dr. J. E. Gray had described a species of deer, received by the Earl of Derby from Chili as *Cervus leucotis* (Annals of Nat. Hist. ii., Jer. Tom. v. page 324, 1840, and Proceed. Zool. Soc., 1849, page 64, pl. 12), which name he soon changed to *Furcifer Huamel* (Annals chr. iv. 427), and at last to *Xenelaphus huamel*, adding to his first description new notices, with the figures of the horns of the male (Proceed. Zool. Soc., 1869, page 496), and the skull of the female, and stating that his *Cervus leucotis* is identical with the *Cervus chilensis* of Gay. This exposition proves that the Huemul or Guemul is already a very well known animal, and has by no means been overlooked by naturalists.

A young collector in Buenos Ayres, Mr. Franc Moreno, has lately received a pair of these animals from Patagonia, where they were caught by the Indian Pehnelches, who live on the western foot of the Cordilleras, near the sources of the rivers Negro and Colorado. These two specimens have been brought to the public Museum, where I have examined them carefully. The male is a young one, with horns still covered by the skin, and only 3 in. long, without branches. I regret that therefore I can say nothing about the figure of the adult's horns, which are according to the drawing given by my dear friend, Dr. Gray, very like that of the roebuck, although the specimen he has figured may be regarded as in an abnormal state, from the great difference between their two sides. Both sexes of the animal are of equal size—3 ft. high on back, and 4½ ft. long, the head being 10 in. long, the ears and the neck 7 in. every one, and the body 3 ft. without the tail, which measures 7 in. with its hairs, but only 4 in. in the axis. Great naked lachrymal pits are seen below the eyes. The fur is of the same quality in each, but very different in the cold and in the warm seasons; then both skins are in the time of hairing, the female with the prevailing hair of the winter, and the male with the prevailing of the summer. Each hair is not entirely straight, but some are undulated, principally on the under half, and this undulated portion has a clear greyish-brown colour; over this clearer portion comes a broad dark-brown or black ring, and the end is clear reddish yellow, with a fine blackish tip, generally broken off in old fur. For the winter dress the hairs are 2 in. to 2¼ in. long, and of a less characteristic colour, being over the whole skin of an undistinguished greyish-brown colour; but in the summer dress the hairs measure no more than 1¼ in. or 1½ in., and all their colours are cleaner and better pronounced. Therefore the animal is darker and more distinguished in colour in the summer than in the winter. The hairs on the face are very short, as are those on the outside of the ears, somewhat longer on the legs, but nearly as short on the under half part of the extremities. The breast and the tail have the longest hairs. Different in colour are the naked nose and upper lip, both entirely black; the breast is dark blackish-brown, the genital region to the tail, with the inside of the hinder upper legs being white. The same colour also pervades the inside of the ears, which are coated with long hairs; the hoofs are black. No tinge of the particular stripe of longer hairs on the tarsus of the hinder legs is conspicuous in either sex; but I find, with Dr. Gray, a large tuft of longer hairs on the hock, on the inside behind, which makes this part of the legs very thick.

The animal lives principally in the valleys of the Cordilleras, but on both sides, the eastern and the western, and rarely goes down to the flat country of the Argentine pampas. Its proper range is between 35° and 45°. It is well known by the Indians, who not only make use of its strong skin for war-dress, and its meat for food, but also tame young animals, using them for domestic employment, like the Guanaco, which lives in the same territory, but is much more common, and therefore almost the only animal used for hunting by the same people.

Buenos Ayres, Sept. 20 DR. BURMEISTER

The Diverticulum of the Small Intestine considered as a Rudimentary Structure

I MUST claim the opportunity of reply to the article which appeared in your number of October 16 (vol. viii p. 509), entitled "On the Appendix Vermiformis and the Evolution Hypothesis," which the writer offers as a commentary on my little paper at the recent meeting of the British Association, "On the Diverticulum of the Small Intestine considered as a Rudimentary Structure."

The writer seems to have been misled by newspaper reports. None of these were furnished by me, or submitted to me before publication, and in those which I saw after their publication both the anatomy and the argument were grossly and indeed absurdly blundered. This applies not only to my paper and remarks, but to the remarks made by those who spoke on my paper. It was, perhaps, too much to expect newspaper reporters not to get confused among scientific terms, and I may have erred in not having the usual abstract of my little paper ready to hand to the reporters.

Newspaper reports may be passed without notice, but I cannot allow an article in a scientific periodical to pass in which the writer uses such language as the following, with which the article in your columns concludes:—

"To quote the words of one of the greatest of our physiologists, it can only bring ignominy on the body of scientific workers if they are supposed to countenance such an argument as that of Prof. Struthers, which assumes that because one or two individuals have died from the impactation of cherry-stones in the appendix vermiformis, therefore there is no God!"

The "no God" was certainly not in my paper or in anything I have ever written or spoken, and the accusation is to me so offensive that I repudiate it with indignation. How anyone should suppose that the evolution hypothesis implies that there is "no God" I am at a loss to understand. I supposed it to be well understood that, on the contrary, that great hypothesis enables us to rise to higher conceptions, the only question being the mode of proceeding.

As to the scientific argument, it seems hopeless to attempt to unravel the confusion into which newspaper reports and my critic have brought it, except by re-stating my argument. But this is for the most part unnecessary after your publication of my abstract in the number following that in which the article of which I complain appeared. It cannot be absolutely proved that the appendix vermiformis is useless, though a survey of the facts in comparative anatomy and development leads to the inference that it is a rudimentary structure. But my paper was on the diverticulum, the appendix being referred to only collaterally, and more for the sake of clearing away the most unnecessary teleology with which it has been encrusted, than with the view of resting the argument on it. The diverticulum, like the appendix, has glands and muscular layers, secreting and expelling; it has villi, actively absorbing; and it is large, which the appendix is not. Yet, notwithstanding all this elaborate construction and this activity, who will maintain that this unclosed bit of the vitelline duct has been left unclosed in some of us for use? But one is sometimes met with the remark that, if these rudimentary and variable structures are useless, they are at any rate not injurious. But is it so? May they, and do they, not become injurious under disease or accident? There is the male mamma, for instance, which we have sometimes occasion to excise for disease. Whatever may be the law which regulates the evolution of the sexual organs, no "use" theory can account for the presence of that rudimentary organ. But the diverticulum is a possibly injurious structure not merely as a tissue, but in addition, specially, as forming, if I may use the word, a kind of trap, by lodgment or by strangulation. Thus we find that we have, whether we will or no, reached the conclusion that there are parts in the animal body which are not only useless but worse than useless because dangerous.

I do not see any reply to this in my critic's remark that it proves too much for the argument, that, for instance, because some people have died from wounds of the scalp, therefore the head might be dispensed with. For, however much the head may vary among us, it is not a rudimentary structure. No argument can affect the fact that the diverticulum is not only a useless structure, but worse than useless because dangerous. The object of putting it thus emphatically is both to establish and to call attention to the conclusion that there are such things in animal bodies as rudimentary structures, things which are of no use to the animal body which contains them, and which can be understood only by referring to other animal bodies in which they are in full play; and that we must therefore rise to higher conceptions of the mode in which these things are regulated. It was carefully stated in my paper that the consideration of such parts as the diverticulum does not carry us further than to clear away the old argument, but that, on taking a survey of rudimentary structures generally, we are led on to the conclusion that the evolution hypothesis is the more probable one in regard to the mode of origin of animal bodies.

The nature of the diverticulum and its sources of danger are well known to the readers of Meckel, Monro, Lawrence, Rokitanski, and Cruveilhier. I may be allowed to mention that nearly twenty years ago I published (Edin. Med. and Surg. Journal, April 1854) twenty cases of diverticulum, with a drawing of each. In three of these it was the cause of death, and I referred to some other cases in which it caused death as reported by previous writers. Anyone in London who is desirous of seeing a case in which it caused death, may do so by looking into the museum of St. Bartholomew's Hospital. There is, I may mention, a diverticulum, at the usual place, in a subject now being dissected in my anatomical rooms. If my critic will come to Aberdeen I will show him a large collection of them, and also of specimens showing the various positions and conditions of the appendix vermiformis, and, indeed, many other interesting rudimentary structures and variations which, I infer, he has not yet seen.

My critic's objection that such discussions are unnecessary, that the true theory will ultimately prevail from its own intrinsic value, might be urged against all discussion; and I differ from him very much if he thinks that the question does not require to be stirred among and by the teachers of human anatomy in this country. The cause of my little paper, in fact, was my having, not long before, heard a teacher of human anatomy, at a similar meeting, call in question the whole argument from rudimentary structures. I attributed no importance to my paper further than that, in bringing forward the diverticulum, it submitted an illustration for the argument which does not admit of cavil.

Aberdeen, Nov. 22 JOHN STRUTHERS

The Atmospheric Telegraph

WILL you permit one of your subscribers who is interested in the credit of the English telegraphic system, to supplement your article of November 27 by a few remarks?

The distribution of telegraphic messages by means of air was introduced by Mr. Latimer Clark, and had been employed by the Electric Telegraph Company long before it was adopted either in Berlin or Paris.

The *Times* article of November 15 deals with the undertaking of the Pneumatic Despatch Company for the conveyance of parcels and goods, not messages. The writer incidentally mentions the transmission of messages, but scarcely seems to have been aware of the extent of the London message system.

If I might encumber your valuable space by statistics, I could show that the pneumatic system of the Postal Telegraphs, or even that of the Electric Telegraph Company at the time of the transfer of their undertaking to the State, will bear comparison, both as to extent and efficiency, with that of Paris, effective as the latter is.

The system is employed in Manchester, Liverpool, Birmingham, Glasgow, and Dublin. R. S. CULLEY

Engineer-in-Chief of Postal Telegraphs

General Post Office, Nov. 29

SENSATION IN THE SPINAL CORD

THE principle which I endeavoured some years ago to get recognised as the directive principle of research in Nerve Physiology, was that everywhere identity of Tissue carried with it identity of physiological Property, and that similarity in the structure and connections of Organs involved corresponding similarity in Function. Although these premisses were almost truisms, the conclusion drawn—that all nerve-centres must have a *common* Property, and *similar* Functions—was too much opposed to the reigning doctrine, to find general acceptance. Especially was it resisted in its application to the functions of the Spinal Cord; and this because of the two hypotheses current, namely, that Reflex Action did not involve Sensibility, and that the Brain was the sole Organ of the Mind. Following in the track so victoriously opened by Pflüger, I brought forward what seemed to me decisive evidence of the sensational and volitional functions of the Spinal Cord; but this evidence has not been generally deemed conclusive by those whose verdict is authoritative. Neither in Germany nor in England have the majority of physiologists consented to regard the actions determined by tthe Spinal Cord in the absence of the Brain as sensitive actions.

This is not the place to examine the insufficiency of the evidence which is held to exclude sensation from Reflex Action, nor to exhibit the irrationality of the conception of the Brain as the Organ of Mind—which, as I have elsewhere said, is not more acceptable than would be the parallel conception of the Heart as the Organ of Life. The purpose of the present paper is restricted to the examination of the most striking experimental evidence *against* the sensational function of the Spinal Cord, which to my knowledge has hitherto been advanced. I had intended reserving the criticism for its appropriate place in the "Problems of Life and Mind," but an article by Mr. Michael Foster which has just appeared (*Journal of Anatomy and Physiology*, November), on the Effects of rise of Temperature on Reflex Action, induces me to bring the subject before the readers of NATURE, in the hope that some of them may re-investigate it and record their results.

I will merely remark that the microscopic investigations which have recently been made with greatly increased powers and better methods of preparation, have more and more confirmed my assertion of the histological identity of Spinal Cord and Brain. On the other hand the experiments of Goltz (*Functionen der Nervencentren des Frosches*, 1869, p. 128) seem to supply direct evidence against the identity of property; and this evidence cannot be ignored.

Goltz observed that a frog, when placed in water the temperature of which is slowly raised towards boiling, manifests uneasiness as soon as the temperature reaches 25° C., and becomes more and more agitated as the heat increases, vainly struggling to get out, and finally, at 42° C., dies in a state of rigid tetanus. The evidence of feeling being thus manifested when the frog has its brain, what is the case with a brainless frog? It is absolutely the reverse. Quietly the animal sits through all the successions of temperature, never once manifesting uneasiness or pain, never once attempting to escape the impending death. "The spinal soul sleeps, perhaps; it takes no heed of the danger. One must waken it. I touch with acid the skin of its back in that part which is raised above the surface of the water. *Swiftly and surely the hind paw is brought to bear on it, and the acid on the irritated spot is wiped away;* then the leg resumes its comfortable position."

The water grows hotter and hotter, but the brainless frog never moves, till, at 56° C., it expires in a state of tetanus.

This contrast is assuredly marked enough, and most readers will be disposed to admit that if the brainless animal can endure, without manifesting even uneasiness, what in the normal animal produces every sign of intense pain, the conclusion that the brainless animal feels nothing, and therefore that his Spinal Chord is not a sensational centre, is irresistible. This conclusion I altogether reject. Not that I question the facts, for I have verified their accuracy; and Mr. Foster, who has repeatedly verified them, only points to the new difficulty which they raise, namely, why the brainless frog is not excited to reflex action by the stimulus of hot water? It is, therefore, the interpretation of the facts to which attention must be drawn; and to make this complete, let me here note counter facts which my experiments presented.

The brainless frog is *not* insensible to the heat, *unless* the insensibility be gradually produced. If its foot be dipped into the hot water the leg is violently retracted; and if the whole or greater part of the body be immersed, the frog struggles vehemently, and rapidly passes into a state of tetanus. The difference between the behaviour of a normal frog and a brainless frog when *suddenly* immersed in very hot water is not greater than might reasonably be anticipated between animals uninjured and animals with one great sensitive centre removed.

These facts are substantially confirmed by the facts brought forward in Mr. Foster's paper. He also finds the legs of a decapitated frog withdrawn by reflex action, as soon as the temperature of the water reaches a little over 30° C. "However slowly the water be heated, the feet are always withdrawn at a temperature of 35° or earlier." But he observes that when the whole body is immersed and the water gradually heated, no movement, or only the very slightest spasm of the muscles of the legs takes place.

The point to which he draws attention is, that whereas the stimulus of hot water applied to the *foot* causes reflex action, applied to the whole leg or the whole body it causes none; his explanation is that the depressing influence of heat on the Spinal Cord destroys its reflex powers. This explanation seems to accord very well with all his observations, but is not in accordance with the fact mentioned by Goltz of the frog's wiping away the acid which is dropped on its back; a fact clearly manifesting the presence of reflex sensibility.

It is this fact which I should urge against Goltz, and all who share his views. It proves, to my mind, that although the frog remains motionless in the heated water and shows no sign of pain from the stimulus of heat, this is assuredly not because Sensibility in general is gone, but simply because Sensibility to *temperature* is gone. It is not necessary to refer to the many well-authenticated cases of analgesia without anæsthesia, of insensibility to pain or temperature without insensibility to touch; I will parallel Goltz's case of the brainless frog suffering itself to be boiled without moving, by the case of the frog with its brain and other nerve centres intact, allowing its legs to be burnt to a cinder without moving. In a paper read at the Aberdeen Meeting of the British Association, I brought forward some experiments on frogs after their skins had been wholly or partially removed. (There were small patches of skin left on the head wherewith to compare the effects of stimuli). These frogs assuredly had not lost their Sensibility; they responded, as usual, to any stimulus applied to the patches of skin which remained; and as these responses were the responses of animals in possession of a brain, no one would explain them away as *mere* reflexes. Yet these sensitive frogs allowed their flayed limbs to be pinched, pricked, cut, burnt with acids, and even burnt to a cinder with the flame of a wax taper, yet remained motionless under all these stimuli, though a touch on the patch of skin would make them wince or hop away.

I did not try the experiment of boiling one of these frogs, but who can deny that the insensibility they presented with their brains and without their skins, is even greater than that presented by brainless frogs with their skins? The point urged is that the frog without its brain is incapable of feeling the stimulus of hot water, which, when the brain is intact, is felt intensely; and the conclusion drawn is that the spinal cord is not a sensational centre. But this point is blunted when we find that the frog is equally insensible to the heat, when its brain is intact and only the skin removed. Ought we to conclude that the skin is the sensational centre? The one conclusion would be as logical as the other.

Mr. Foster, who is only treating of the influence of temperature, asks why the sensations and *cerebral* processes are not dulled in the same way as he supposes the *spinal* processes to be dulled by heat? "The answer," he says, "is that a less intense sensory impulse is needed to call forth a movement of volition, that is, a movement carried out by the encephalon, than an ordinary reflex action, that is, a movement carried out by the spinal cord alone. The water as it is being warmed suggests a movement to the intelligent frog long before it is able to call forth an unintelligent reflex action. The very first movement of the frog, the removal of any part of his body out of the water, increases the effect of the stimulus; for the return of the limb to the water already warm gives rise to a stronger stimulus than contact with the water raised to the same temperature while the limb is still in it; and thus *one movement leads to another* and the frog speedily becomes violent. It is nearly the same with the brainless frog when a movement has for some reason or other been started; only in the observations we have been dealing with this initial movement is wanting."

Let us compare the energetic movements of the normal frog and the absence of movement in the brainless frog, with the energetic movements of a waking man in a suffocating atmosphere, and the absence of movements in the sleeping or stupefied man in the same atmosphere, and all the phenomena are clear. The waking man and normal frog are alert and alarmed. The sleeping man and brainless frog remain motionless. Instead of our being surprised at the brainless frog manifesting so little Sensibility when the gradually-increasing heat is threatening its existence, we ought to be surprised at its manifesting so much Sensibility as a thousand experiments disclose; especially when we see that if the heat be suddenly applied the Sensibility is manifested as *equally* energetic in normal and in mutilated frogs.

In conclusion, let it be observed that unnecessary obstacles are thrown in the way of rational interpretation when connotative terms such as Spinal *Soul* (*Rückenmarkseele*) are adopted. It is one thing to assign a general physiological Property, such as Sensibility, to the nervous centres; another thing to assign a term which is the abstract expression of the connexus of sensibilities, to any one centre. In saying that the Spinal Cord is *a* seat of sensation, it is not meant that it is *the* seat, nor that the sensations are *specifically* like the sensations of colour, of sound, of taste, of smell; but they are as like these as each of these is like the other.

GEORGE HENRY LEWES

*THE ARTISTIC REPRESENTATION OF NATURE**

THE late autumn of every year introduces to the public a large supply of gorgeous volumes, "got-up" in lavish fashion with handsome plates and lightly-written letter-press, which are generally spoken of as Christmas Books, and are intended to be the means for the material expression of the generous feelings which that season is

* "The Life and Habits of Wild Animals." Illustrated by Designs by J. Wolf. (Macmillan, 1873.)

supposed to evoke. The work to which we wish to call attention is not intended to be one of these, though its exterior appearance might, at first sight, be thought to warrant the supposition. It is a special work brought out under special circumstances, and, as we are told in the preface, the plates have been engraved for nearly seven years. We refer to it, and shall speak of some of the pictures in detail, as showing the service which Art can render to Science by a faithful representation of Nature. The more scientific Art is, the more successful and the more impressive she will be; only by a thoroughly scientific study of his subject and its surroundings can an artist hope to achieve complete success.

The book derives a special, though a painful interest, from the fact that it contains the last series of illustrations which will be drawn by a highly-talented German artist—Mr. Wolf—the previous productions of whose pencil are so well known to all who find pleasure in the study of the animal world. The volume is illustrated by twenty plates, beautifully engraved by Messrs. J. W. and E. Whymper, each of which depicts some stirring scene in the life of "our four-footed friends," or puts before us some picture of the life of birds, some of them representing in a terribly graphic manner the struggles which pervade the existence of beasts, and render its tenure so precarious. Witness the subject of plate iii.—one of the most powerful in the whole series—the death-grip of the crocodile's cruel jaws upon the handsome head of the tiger drawn slowly and resistingly beneath the stream where the conqueror will make his banquet. There is no one who would not feel, in gazing at this picture, a strong sympathy with that most splendid of the feline tribe in this his death-agony. We do not select this plate as superior in draughtmanship to its fellows; they are all of the same high order of merit, though some naturally arrest the attention more forcibly than others, in proportion as the feelings which connect man *quâ* animal with his fellow-animals find fuller expression with regard to the nobler and higher specimens of animal life.

And here we would say that pictures like these—not mere passive delineations of the outward shapes, but illustrations of the habits of wild animals—have an instructive and suggestive value. They are pictures which set one thinking. There is a dramatic reality about them which leads the mind into the by-paths of contemplation as no still outline can—they irresistibly compel us to compare with ourselves these denizens of the forest and the prairie, of the river and the sea. We seem at once to be impressed with the consciousness of their irresponsibility, of their independence of ethical restraints, obeying as they do but one law—the law of their kind—which incidentally leads them to the destruction of other kinds inferior to their own. The half-human looking ape does not allow us to predicate the conception of morality of any of its actions; the care of its young which it evinces is but an exhibition of the instinct of self-preservation which pervades all species of the higher animal forms; it is difficult to realise that the gap between man and monkey is anything less than a so-called difference of kind. Many other reflections are suggested by a sympathetic survey of such animated drawings as these, but we will not weary our readers with subjective digressions, which must necessarily vary with the individuals who indulge in these reflections; we are only eager to impress the superiority in this regard of delineations of active life and habits over mere portraiture, however well executed, of individual forms of life.

We are glad to be able to reproduce one of the most pleasing of the plates which adorn Mr. Wolf's work—"The Island Sanctuary." There is a peaceful lonely beauty about this representation of the osprey's haunt, which at once arrests the attention and forms a strong contrast with the depictions of the more savage warfare of species against species, of panther against doe, of lion against deer, of wolf against boar, which are contained in the same volume with it. The siesta of the jaguar (plate ix.) and the bath of the large pachyderms, elephants and hippopotami (plate x.), are two of the most striking drawings in this volume, the former especially we think inimitably excellent. There is an idyllic completeness in the representation of the largest of the American cats taking its ease during the midday heat on the branches which overhang the river. Without going into further detail concerning the separate plates, which require to be seen to be appreciated, we would mention one more, Catching a Tartar (plate xviii.), the most sensational in the series, very forcibly drawn, the dead or dying owl's wings have lost their motive power, but in their outstretched hugeness serve to break the rapidity of the descent and save the weasel, whose "cunning has proved more than a match for the strength of the more powerful" bird.

We speak in a somewhat popular strain of Mr. Wolf's work, not with any intention of treating it as one of the hastily concocted products of the winter season, which, as we have said, it is not meant to be, but rather from a belief that it will appeal to those who, without a special scientific or zoological training, have yet a genuine love of contemplating the varied phases of life in beast and bird, who believe with Coleridge, that

> "He prayeth well who loveth well
> Both man and bird and beast,"

and to such as these we can say that this volume is of no common sort; the pictures are such as stir the imagination and please the taste, while, as justly remarked by Mr. Whymper in his preface, their value is greatly enhanced by the "power of delineating specific characters" which is displayed.

We must not omit to mention, in connection with Mr. Wolf's plates, the letterpress which accompanies them, and which is from the pen of Mr. Daniel G. Elliot, of the United States. It is, of course, in this case subservient to the drawings which it interprets. In his outspoken preface, to which we have already referred, Mr. Whymper tells us that Mr. Elliot has laid aside the scientific treatment of his subject, for which he is fully capable, as bearing in mind that "the book is intended for the general public, and not for a class." Our American cousins are always masters of the art of depicting in animated and picturesque fashion all that is of interest in life and action, whether in man or in beast; and Mr. Elliot has not failed in the task set before him; he has steered clear of fulsomeness, and cannot be accused of padding; his writing is instructive with respect to the habits of animals, and is not of that ejaculatory kind which too often accompanies pictures and seeks to impress the character of eloquence by a copious interlarding of interjections. We can give in one quotation a fair example of his portion of the work. Speaking of the gorilla he says:—"In the pathless tracts of those ancient woods, distant even from the primitive abodes of hardly less savage men, in company with the fierce inmates of the jungle, the gorilla dwells, surrounded by his family. Peacefully they pass the day, seeking the various fruits that in many a cluster hang from the lofty trees, paying generally but little attention to what is passing below them. But if any unusual sound breaks the stillness of the woods, or a strange form be seen approaching their vicinity, then the females, bearing their young clinging fast to them, flee away into the still deeper recesses of the forest; while the father and protector of the small community, swinging himself rapidly from tree to tree, tearing loose the vines that stretch across his passing form, advances towards the object of their fears, and before imitating the rest in their speedy flight, satisfies himself in regard to its presence, and then with many a hideous grimace, and short hoarse call, demands to know, in impatient tone, Who comes here?"

THE ISLAND SANCTUARY

ON THE SCIENCE OF WEIGHING AND MEASURING, AND THE STANDARDS OF WEIGHT AND MEASURE *

IX.

IN the comparison of standard weights, the difficulty and risk of error in determining the weight of air displaced by them is to be avoided by weighing them not in air, but in a vacuum. Two methods are employed for this kind of weighing.

In the first and simplest method, when an ordinary balance of precision is used, each standard weight is placed in an exhausted receiver just large enough to hold it, and is weighed separately against a counterpoise by Borda's method. Sensible discordances have, however, been found in the results of this method of weighing in exhausted receivers, which render its use inexpedient when scientific accuracy is required. These discordances are perhaps attributable to a small quantity of air being present in the receiver during the weighings, the amount of which cannot be accurately determined. Another probable cause is a change in the temperature and atmospheric pressure affecting the balance itself and the weights in the pans during the long time necessarily occupied in the whole process of this method of weighing. Indeed it may be generally stated as a rule that the risk of discordances in the results of weighings is in proportion

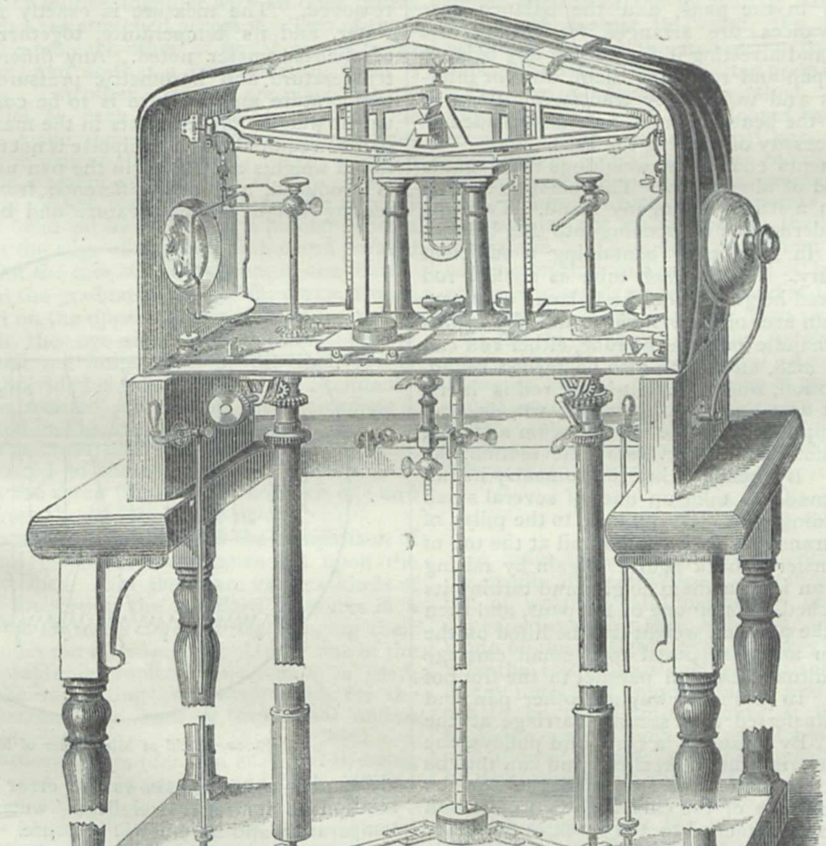

Fig. 19.—New Vacuum Balance of the Standards Department.

to the time occupied in the operation. Such discordances are not found when the weighings are made by the second method, when a vacuum balance is used, that is to say, when the balance case itself is made an exhausted receiver.

A vacuum balance has been constructed at Paris by M. Deleuil, and is now used at the Conservatoire des Arts et Métiers, consisting of a balance of the best construction placed in a very strong cast-iron case that can be made perfectly air-tight. This case has four circular openings for giving admittance and light to the inside, which are closed with strong glass covers. It has a stuffing box for the handle of the lever by which the balance is put in action and arrested. This balance has been found to give very accurate results of weighing in a vacuum. But the comparison of standard weights in this vacuum balance takes a considerable time from the necessity of opening the case and re-establishing a vacuum at least a second time in order to change the weights in the pans even when Borda's method is used; and occasionally this must be done again if a small additional balance weight is required to be placed in either pan, in order to obtain a sufficiently approximate equilibrium, so that the pointer may not exceed the limits of the index scale.

* Continued from p. 49.

Some improvements on Deleuil's vacuum balance have been designed by Prof. W. H. Miller, and have been practically carried out in a vacuum balance constructed by Mr. Oertling for the Standards Department. The balance case consists of a strong brass frame cast in one piece, with a rectangular base, two sides, and an arched top. Two solid glass plates, each $1\frac{3}{4}$ in. thick, form the front and back of the case, being clamped to plane surfaces of the brass frame, and made air-tight by interposing thin india-rubber. They are thus removable when required, for instance, when any alteration is needed in the balance. There is a circular opening $4\frac{5}{8}$ in. in diameter, on each side of the brass frame, similar to those on Deleuil's balance, to which glass covers are fitted. There is no stuffing-box, but when the Standard weights to be compared are placed in the pans, and the balance case exhausted, contrivances are arranged for putting the balance in action and arresting it, for adding any balance weights to either pan and removing them, and for interchanging the pans and weights by transferring them to the other end of the beam, without any disturbance of the vacuum, or necessity of opening the case.

These arrangements enable the weighings to be made by Gauss's method of alternation. The balance case is firmly placed upon a strong mahogany stand. Two iron tubes are fixed underneath and opening into the balance case. They rest in iron cups containing a sufficient quantity of mercury. Within each tube is a steel rod rising to the required height inside the balance case, and having at the top an arm of convenient form. By means of a simple lever handle outside the tube, either rod can be lifted about an inch, and it can also be turned round. By this rotary motion, when the left-hand rod is in its normal position, it acts upon two bevelled wheels, and thus lowers the supporting frame of the beam and puts the balance in action; and by reversing the motion, the action is stopped. By raising either rod to nearly its full height, it can be made to take up one of several small balance weights riding on a little rail fixed to the pillar of the balance, and transfer it to a similar rail at the top of the pan, or to transfer it back again. Again by raising either steel rod to an intermediate height, and turning its arm under the arched rods of one of the pans, and then raising it a little, the pan and weight can be lifted off the hook of the beam and transposed to a small carriage standing upon a railroad near and parallel to the front of the balance-case. In a similar way the other pan and weight can be transferred to a second carriage at the back of the case. By means of a cord and pulleys, one of which is upon the right-hand steel rod and can thus be turned round with the hand, the two carriages can be moved to the other ends of the case, and then each pan with its weight can be attached to the hook at the other end of the beam. The desired results are all thus attained, and the whole action of the balance is open to view.

The construction of this new vacuum balance may be seen from Fig. 19.

The balance itself is similar in construction to the other Standard balances made by Mr. Oertling. It is constructed to weigh a kilogram in each pan. There are two Standard thermometers inside the case, one fixed to each pillar, and adjustible as to height, so that its bulb may be on the same level as the centre of gravity of the weight. A mercurial gauge is fixed between the pillars, and there is the same arrangement of three tubes and stopcocks communicating with air-pumps and with a mano-barometer, as in Deleuil's vacuum balance. Two glass vessels containing chloride of calcium, are also introduced for absorbing any moisture in the balance case.

There are two ways of comparing and verifying standard measures of capacity. The first and most accurate, as well as scientific method, is by weighing their contents of distilled water; the second method, which is simpler and more ordinarily used, consists in comparing the measure of water contained in them, with the contents of a verified standard measure.

In weighing the contents of distilled water contained in a standard measure, when quite full to the brim, and with the surface of the water made accurately level by a disc of plate glass slid over it, Borda's method of weighing is employed. The measure with its disc is placed empty in one of the pans of the balance, and is accurately counterpoised. A verified standard weight equal to the legal weight of water contained in the measure is then added to the pan containing the measure and disc, and is accurately counterpoised, and a sufficient number of weighings is taken until the mean resting-point of the balance is determined and noted. The standard weight is then removed. The measure is exactly filled with distilled water, and its temperature, together with the reading of the barometer noted. Any difference in the actual temperature and barometric pressure from the normal temperature and pressure is to be compensated by equivalent weights placed either in the measure pan or weight pan as required. If an equipoise is not now obtained, additional weights are placed in the pan until an equilibrium is produced, and any difference from the normal correcting weight for temperature and barometric pressure

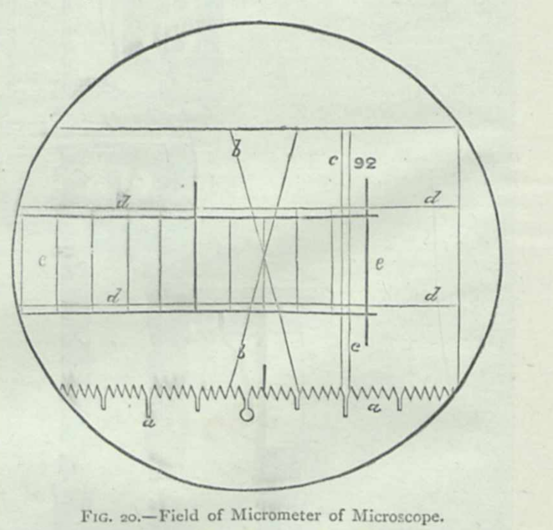

Fig. 20.—Field of Micrometer of Microscope.

either plus or minus, shows the error of the measure in relation to its legal weight of water at the standard temperature and barometric pressure.

For ascertaining the exact amount of the proper corrections for temperature and barometric pressure, authoritative tables are computed both for Imperial and for Metric Measures. Such tables will be found in the Papers appended to the Fifth Report of the Standards Commission, published in 1871 (pp. 81, 193, and 196), and to the Sixth Annual Report of the Warden of the Standards, published in 1872 (pp. 49 and 51).

With regard to comparing instruments for standard measures of length, their construction has necessarily varied according to the form of the standard measure. As has been already stated, the earlier scientific standards of length were defined by two points, and all comparisons were made by means of a beam compass.

The introduction by Mr. Troughton of the use of the micrometer microscope was a great step in advance towards the attainment of scientific accuracy in the comparison of our standard measures of length. It enabled optical observations to be made without injurious contact to the defining points or lines, and thus without interference with the permanence of the measures. Several descriptions of comparing apparatus with micrometer microscopes have been constructed at various times, but all are made upon the same principle. The microscope is fixed in a vertical position, and is provided with a spirit level and with screws for accurate levelling and focal adjustment. The defining marks of the two standard measures to be compared are brought successively under it, their height being adjusted to the focal distance of the microscope. Any difference of length between the defining marks of the two measures is read off from the graduated head of the micrometer. This part of the apparatus consists of an endless screw with the very finest threads, having a large head divided into 100 parts. The screw is placed in a horizontal position, and when turned carries with it a nut moving in horizontal guides, together with an open frame, which has cobweb lines stretched across it. Two of these lines (*b b* Fig. 20) cross each other at equal angles to the axis of the screw, and so that a line bisecting them is normal to its axis. Two other lines (*c c*) are placed nearly close, and parallel to each other and normal to the axis of the screw; and there are two longitudinal lines (*d d*) parallel to the axis of the screw, by means of which this axis is made parallel to the axis of the measure under observation. When turning the screw, the number of revolutions is read off by the aid of a pointer from a rack (*a*) placed at the edge of the open frame and parallel to the screw, whilst the number of divisions in one revolution is read off on the graduated head of the screw, from a fixed line marked on the upper surface of the microscope. Looking through the eye-piece of the microscope at the magnified first ten hundredths of the inch 36—37 marked on the subdivided standard yard of the Standards' Department (here inverted), the field of the microscope is seen as represented in Fig. 20.

In this figure the cross lines are used for observation, and are seen adjusted to the 0·03 in. line. The pointer at the rack shows the screw to be turned between one and two revolutions from the middle of the field.

All micrometer microscopes used for the comparison of standard measures of length are constructed upon the principle thus described. But there are various kinds of arrangements for supporting the standard measures in a proper position, and for more conveniently bringing their defining marks under the microscopes. Under one of the arrangements, a single micrometer microscope is used, and fixed over the supporting apparatus, which, for the purpose of comparison, has both a transversal and a longitudinal displacement.

The two standard measures (denoted as A and B) being placed with their axes exactly parallel, and their defining marks as nearly as possible in the same line normal to the axes, the left-hand defining mark of A is brought under the microscope, and the position of the micrometer read off on the index scale and noted. By the transversal displacement, the left-hand defining mark of B is next brought under the microscope, and the reading of the index scale noted. The two measuring bars are then moved their whole length by longitudinal displacement, and the right-hand defining marks of A and B successively read off and noted, thus affording the means of ascertaining the difference of length of the two standard measures. The temperature of the bars at the beginning and end of the observations must be determined by thermometers, and the mean temperature noted, and allowance must be made by computation for any difference of length arising from unequal expansion or contraction of the two bars, when this temperature differs from the standard temperature. For this purpose it is absolutely necessary that the coefficient of expansion of each standard bar must be previously determined.

This method of comparing with a single microscope is used in France, but not in England, where the risk of error arising from the longitudinal movement of the bars is avoided by using two microscopes, and only a transversal displacement of the bars during the observations, although there are also means of longitudinal displacement for the purposes of adjustment. The objection raised against the use of two microscopes, that the distance between them may vary during the period of observation by the expansion or contraction from alteration of temperature of the material which unites them, is obviated by fixing them firmly and independently upon a solid stone support.

Placing measuring bars directly upon a plane support is objectionable. It has been proved that there is a risk of discordances in comparisons being caused by almost undiscoverable inequalities in planed surfaces, as well as by a difference of temperature in the plane surface and the under surface of the measuring bar, when thus placed. To guard against this risk, the bars are supported upon rollers, and the measuring bars ought to be stiff enough to bear to be supported upon a few points at which rollers can be conveniently applied. For a short bar two rollers are sufficient; for a longer bar more supports are required. The standard yard bars are supported upon eight rollers, and it is always requisite that each support should exert the same vertical pressure upwards, in order that the interval between two points upon the surface of the bar may not be altered by the flexure. This object is attained by a proper arrangement of levers; and it is easily seen that an arrangement of levers by which equal pressure upwards may be exerted at four or eight points is very simple. Each bar rests upon two brass lever-frames.

It has been shown by the Astronomer Royal, in his paper printed in the Royal Astronomical Society's Memoirs, vol. xv., that the value of the intervals (supposed equal) which ought to exist between different supports of a bar, each support exerting the same vertical pressure upwards, is as follows: n being the number of supports, the resulting intervals of supports is:—

$$\frac{\text{length of bar}}{\sqrt{(n^2 - 1)}}.$$

In order to ascertain with scientific precision how far the results of comparisons of standards obtained by the use of weighing and measuring instruments are to be depended upon for their accuracy, a calculation is to be made of the probable error of every such result, whether it be the result of a single comparison, or the mean result of any number of comparisons. And when other elements are to be taken into account, it is necessary that the probable error of each computation should be determined and allowed for before the final results of comparison can be determined and allowed for.

The mode generally adopted for calculating the probable error is based upon the method of least squares, and is fully stated by the Astronomer Royal, in his "Theory of Errors of Observation," pp. 44-7.

H. W. CHISHOLM

EARTH-SCULPTURE *

II.

YOU are aware that the revival of the half-forgotten doctrines of the early Scottish School of Geology has not been without vehement protest on the part of the older geologists, who have been inclined to treat them rather as novelties and departures from the older and purer faith. No one resisted them more determinedly than my much-missed friend and benefactor, the late Sir Roderick Murchison. He looked with regret, and even, perhaps, sometimes with a little alarm, upon their advance, and to the last he battled against them. He was, indeed, in this country the leader of his party, which has been called the "Convulsionist School," and his death

* Opening Address to the Edinburgh Geological Society, by Prof. Geikie F.R.S. (continued from p. 52).

has, doubtless, been a severe blow to that school, as it has been a loss to all who admired a straightforward, courteous, and undaunted antagonist.

Other members of the party have, however, in more or less direct ways, lifted up their voices of protest. I select this evening one of these antagonists, partly because he has spoken more and more energetically than any other, and partly because a good deal of his speaking has been directed against myself. And here I am sorry that I must begin by a reference to a matter of personal history. In the summer of 1865 I published a little volume, now out of print, on "The Scenery of Scotland, viewed in connection with its Physical Geology." The object of that work was to show how completely the Huttonian doctrine of earth-sculpture was borne out by the mountains and valleys of the northern part of this island. I distinctly disclaimed any novelty or originality on my own part in the broad doctrine which I tried to enforce. My veneration for Hutton and Playfair had been from boyhood profound; again and again in the pages of my book I quoted them, and spoke of them as the founders of the school to which I professed myself a loyal adherent, and in which I could boast such friends and colleagues as Jukes and Ramsay.

I was well aware, and stated in the preface, that the views to which I had been led "ran counter to what are still the prevailing impressions on this subject," and that I was prepared to find them disputed, or thrown aside. Convinced, however, of their essential truth, I looked forward to a time when what might then be regarded as mere dreaming would be established as a recognised part of the groundwork of geology. The views put forward in the volume met, indeed, with an amount of general acceptance which I could hardly have anticipated. But at length the expected opposition made its appearance.

On February 3, 1868, his Grace the Duke of Argyll read to the Geological Society of London a paper, entitled "On the Physical Geography of Argyleshire, in connection with its geological structure." Although that title was chosen, the paper proved really to be from beginning to end a criticism of my little book, which, indeed, the author candidly acknowledged to have served him as "the best text he could find."

To that paper I made no reply. It seemed to me that the noble author had failed to perceive the bearing of the whole argument from geological waste, as proved by geological structure. His objections being already, in my opinion, anticipated in the book which had called them forth, I did not see how I could make my case plainer by any amount of additional argument. But further, his Grace had begun his communication with a sentence in which he stated that the views set forth by me "seemed to be gaining ground with the younger school of geologists,"—fatal admission, as it occurred to me, for I felt that what was called the younger school must eventually take the place of that which styled itself the older, and that if it remained true to its belief, the views which were now called in question would carry the day without any battling of mine. Every month shows more fully the justice of this anticipation.

I was content to let the matter rest; nor would I recur to it now, but for the following reasons. Since that time the Duke of Argyll has become President of the Geological Society of London. In his recent address, and in a separate communication to the Society, he has returned to the subject of the origin of the present features of the land, referring to his former paper as "an argument which had not been met by any answer in detail," and adhering, therefore, to the views there expressed. As to the non-appearance of any "answer in detail" from myself, I can give no other explanation than that I considered my little book sufficiently detailed for its purpose, and believed that it already anticipated and answered the argument of my opponent. That is still my belief.

But a broad challenge addressed to the general body of geologists by the President in the official Address which he annually gives to the Society and the world, is not the same thing as a criticism from one member of the Society upon the work of another member. In the interests of science, therefore, it seems to me that some protest is now called for against doctrines promulgated at this late date in the century from so high and honourable position as the Chair of the Geological Society of London; and as I have been especially singled out for attack, it appears to me to be only an act of duty to vindicate, not my own position merely, but the reputation of that "younger school" which is accused of seeking to pervert the geological mind from the ancient and true creed. If these doctrines maintained by the President were to become generally diffused, which, happily, is now impossible, they would suffice to paralyse research in one important branch of the science; for, as far as relates to the history of the configuration of the land, they would assuredly bring down upon us again the pre-Huttonian darkness.

No one whom the Geological Society of London has chosen as its President can fail to command the respectful attention of geologists all over the world. And while I gladly acknowledge this right, I would also express the gratification which is widespread among the brethren of the hammer in this country that the Duke of Argyll, in the midst of so many and so onerous, as well as honourable duties, should find time to take a lively and active interest in the progress of geology. I admire, too, the vigour with which he wields his pen, and the boldness with which he gives his judgment among disputed questions. He has once more thrown down his geological gauntlet, and if I venture to take it up, and accept his battle, it is in the full consciousness of the presence of an adversary who, while dealing hard blows himself, will take in good part such buffets as the fortunes of war may bring to him.

I have already alluded to the natural impression that when we look at a region of rough mountains formed out of hardened and contorted rocks, we behold in the external outlines the direct results of the subterranean force by which the rocks were altered and crumpled. This obvious inference is far older than the days of geological inquiry. But surely its mere obviousness is no argument for its truth, any more than the rising and setting of the sun prove the earth to be the centre of the universe. In the volume already referred to I spoke of it as "dealing with that dreamland of conjecture and speculation lying far beyond the pathways of science, where one has no need of facts for either the foundation or superstructure of his theory. It thus requires no scientific knowledge or training; it can be appreciated by all, and may be applied to the history of a mountain chain by one to whom the very name of geology is unknown." But to recognise that this common and instinctive notion is yet a misleading one, requires an acquaintance with geological structure which comparatively few have an opportunity of obtaining, and which appears to be not always readily acquired at second-hand. I have watched the current geological literature on this question during the last decennium, and the result has been to convince me that the notion, or rather the prejudice which I am combating, is in some minds so deeply rooted that it cannot be got rid of by the reading of any number of books or treatises, and, of course, still less by the writing of them. Simple as may be the statement of the leading principles and facts relative to that waste of the earth's surface to which the term Denudation is applied, there is yet, I firmly believe, no part of geology more difficult adequately to realise. So striking are the difference and contrast between the magnitude of the results adduced and the apparent insignificance and impotence of the forces which are alleged to have produced them, that the mind not unnaturally hesitates to associate the one with the other in the relation of cause and effect. And yet it is only in proportion as one is enabled to master this subject that he is prepared to understand, far less to discuss the origin of the present contours of the land.

In the volume which the Duke of Argyll has singled out to bear the brunt of his attack, I carefully stated at the commencement that I proposed to consider the problem only "in so far as it relates to the history of the scenery of Scotland." I laid down no universal law or dogma by which the hills and valleys of every other part of the world were to be explained. I knew the mountains and glens of Scotland; I had wandered over them and studied them from boyhood; trained in the severe and laborious school of the Geological Survey, I had mapped many hundreds of square miles of their surface, across some of the most complicated pieces of geological structure in the kingdom. It was not, therefore, in any spirit of rashness, or novelty, or dogmatism, but with the growing convictions of many years of experience and in the belief that a service to the cause of geological inquiry in this country could be done, that I ventured to launch my little book upon the world. I was well aware that other regions exhibited features not seen here, and that for these other explanations might require to be found. But it was then no part of my subject to travel beyond my own domain. When the principles for which, in common with my able colleagues in the Survey, I contended were firmly established in relation to the scenery of this country, it would then be time to consider how far they were applicable elsewhere. That they would be found to be not merely of local but of wide general import I then held to be probable, and I now know to be profoundly true.

One main object of my chapters was to show how the present hills and valleys of Scotland had come into existence gradually, one by one, during an enormously protracted period of geological waste in the manner to which I have already referred this evening. I adduced copious proofs from all parts of the kingdom in support of this view, similar proofs having been already triumphantly accumulated by Mr. Jukes in Ireland, and by Prof. Ramsay and others in England.

Far from ignoring the influence of geological structure upon external form, I might even have been charged with having brought forward a needlessly ample accumulation of evidence to show how constantly the resulting contours of the country have been determined by the arrangement of the rocks. I showed how ancient, in a geological sense, the denudation of the country had been, and how thoroughly it had done its work upon the surface, no matter whether the rocks had been originally formed as mere soft mud or had been once in actual fusion. I dwelt on the remarkable fact that as a rule the valleys do not run along lines of fracture, and quoted in support of this assertion the published maps of the Geological Survey of the three kingdoms. To these and similar statements of sober fact which are now part of the common stock of geological knowledge, his Grace opposes such phrases as these: "The facts assumed are, in my opinion, to a large extent purely hypothetical," "This assertion is erroneous," "extravagant demands," "inventions and imaginations," and so on.

(*To be continued.*)

NOTES

THE annual meeting of the Fellows of the Royal Society was held on Tuesday at Burlington House. The retiring President, Sir George Biddell Airy, K.C.B., delivered the inaugural address. The presentation of the medals followed. The Copley Medal was awarded to Professor Helmholtz, the distinguished physiologist, physicist, and mathematician, of Berlin, "whose memoirs have ranged through nervous physiology, hydrodynamical theory, instruments (as the ophthalmometer and the ophthalmoscope) for exact measurement and for medical examination of the eye, and other important subjects, and have been generally recognised as giving real additions to our knowledge." A Royal Medal was awarded to Prof. Allman, F.R.S., "for his numerous zoological investigations, and more especially for his work upon the Tubularian Hydroids. The subject of these labours is one upon which few persons are qualified to enter; and the Council are impressed with the delicacy of the work and the value of the scientific results." A Royal medal was awardep to Professor H. E. Roscoe, F.R.S., of Owens College, Manchester, "for his various Chemical Researches, more especially for his investigations of the Chemical Action of Light, and of the Combinations of Vanadium." Dr. Joseph Dalton Hooker, C.B., was elected President of the Society.

THE alleged reply of the Government on the subject of an Arctic Expedition as reported in the daily papers (*Daily Telegraph* and *Pall Mall Gazette*) is calculated to convey a very erroneous impression. Mr. Gladstone has requested that he may be furnished, in writing, with the reasons for the despatch of an Arctic Expedition, before receiving a deputation on the subject. Those reasons, which we believe to be quite conclusive as showing the propriety of despatching an expedition next year, will at once be furnished to the Prime Minister.

PROF. A. W. WILLIAMSON has been elected a Correspondent of the French Academy.

THE Duke of Northumberland has been unanimously elected President of the Royal Institution, in succession to the late Sir Henry Holland.

THE probable arrangements for the Friday Evening Meetings of the Royal Institution before Easter 1874, are as follows:—Jan. 16: The Acoustic Transparency and Opacity of the Atmosphere, by Prof. Tyndall, F.R.S. Jan. 23: Recent Discoveries in Mechanical Conversion of Motion, by Prof. Sylvester, F.R.S. Jan. 30: Weber and his Times, by Sir Julius Benedict. Feb. 6: The Heart and the Sphygmograph, by Alfred H. Garrod, Fellow of St. John's College, Cambridge. Feb. 13: The Opponents of Shakespeare, by Dr. Doran, F.S.A. Feb. 20: The Autotype and other Photographic Processes and Discoveries, by Vernon Heath. Feb. 27: Men of Science, their Nature and Nurture, by Francis Galton, F.R.S. March 6: Venus's Fly-trap, by Dr. J. S. Burdon-Sanderson, F.R.S. March 13: Graphic Representations of Musical Sounds, by M. Cornu. March 20: The Temperature of the Atlantic, by Dr. W. B. Carpenter, F.R.S., Registrar Univ. Lond. March 27: The Physical History of the Rhine, by Prof. A. C. Ramsay, F.R.S., Director of the Geological Survey of Great Britain.

SIR SAMUEL BAKER has quite recovered from his recent indisposition, and will on Monday next address the Royal Geographical Society upon his adventures in Africa.

WE regret to announce the death of M. De La Rive at Marseilles on Nov. 27, on his way to Cannes. He had had an apoplectic fit about a fortnight previously, from which he seemed to be slowly recovering, though greatly shattered in intellect.

WE rejoice to learn that at a convocation held at Oxford on November 27, the grant alluded to in NATURE a fortnight ago in connection with Dr. De La Rue's gift of astronomical apparatus to the University, was acceded to in a manner creditable and gratifying to all concerned. Thus the University has, we believe, established the foundation of what ought to become a very useful Observatory for Astronomical Physics. One immediate result, we hope, will be to excite Cambridge into vigorous action. Oxford deserves great credit for the efforts she has made during the past few years to encourage the study of physical science; we hope the results will lead her to do so to a still greater extent.

THE fund being raised for the purpose of providing a suitable memorial to the late Prof. Sedgwick, of Cambridge University, reaches nearly 10,000*l.* The form of the testimonial will be some new and suitable buildings for the schools of geology, and a full-length statue of the late professor.

THE Cape mail brings word that the *Challenger* has arrived at Simon's Bay. On her voyage from Bahia she touched at Tristan d'Acunha, and made a survey of the groups of islands to which it belongs. Two Germans were found who had lived there for a couple of years, and who gladly availed themselves of the opportunity of leaving.

THE annual course of lectures of the Brown Institution, under the Government of the University of London, will be delivered in the theatre of the University by Dr. Burdon-Sanderson, F.R.S., on successive Tuesdays and Fridays during the present month, at 5 o'clock in the afternoon. The first lecture will be given on Tuesday next the 9th inst.

PROFESSOR E. WEISS, of the Vienna Observatory, we learn from the *Bulletin International* of the Paris Observatory, has identified the comet recently discovered by Coggia, with the first comet of 1818, discovered by Pons at Marseilles.

WE understand that the Lords of the Privy Council on Education have decided to unite the Professorships of General and Applied Chemistry in the Royal College of Science, Dublin, and that this joint professorship will be conferred on Mr. Galloway, for many years the Professor of Applied Chemistry to the College. The only vacancy to be now filled up in the college staff is therefore that of the Professorship of Zoology.

PROF. N. L. SHALER, Geologist of the State of Kentucky, in a recent letter to the *Frankfort Yeoman*, makes a rather novel suggestion for improving the navigation of the Ohio River, and at the same time preventing the enormous destruction of property which its floods now occasion at intervals, by washing away its banks. In what has hitherto proved a vain endeavour to accomplish the former object, a large amount of money has been already spent under appropriations of the United States Congress, for wing-dams and other structures to concentrate the flow during the season of slack water; and schemes have been considered with more or less favour that involved the expenditure of from ten to forty million dollars. The waste by floods, of property bordering the river, is estimated by Prof. Shaler at 400,000 dols. per annum. He thinks that both objects could be accomplished by simply planting willows upon the banks, as he finds that wherever such a plantation has been effected, the resulting growth not only holds the soil in which it is rooted, but accumulates that which is brought down by the river. When the banks have been sufficiently strengthened and extended by means of such plantations, a deepening of the channel must result, which will improve navigation. The entire cost of planting the banks of the river from Pittsburgh to its mouth is estimated by Prof. Shaler at 100,000 dols.

ON Monday, Nov. 24, a meeting of the Royal Geographical Society was held in the theatre of the University of London, Burlington Gardens; Sir Bartle Frere in the chair. Two papers were read—one by Capt. J. Moresby, R.N., "On recent discoveries at the eastern end of New Guinea," and the other by the Rev. W. Wyatt Gill, on three visits to New Guinea. Capt. Moresby's paper entered at much length into the configuration and aspect of the country, which the author described as not unlike that of Australia. From all he saw of the people, the old idea that they were the most savage of all races must be abandoned. Capt. Moresby's paper described the utensils used by the natives, and looked forward to a better future for them in consequence of their connection with England. The Rev. Mr. Gill then related his experience, which in general confirmed that of Capt. Moresby.

THE late Mr. Robert M'Andrew, F.R.S., of Isleworth House, Middlesex, has bequeathed to the University of Cambridge a very large and valuable collection of recent shells. The collection is one of great scientific interest, and is well known to persons engaged in the study of this branch of natural history. Mr. M'Andrew also bequeaths to the University "such of the purely conchological works in my library as the Vice-Chancellor or any Professor or other official nominated by him shall select, provided they are works which the said University does not already possess (otherwise than in the Public Library of the said University), and such works are to be placed in the Natural History Museum or some library connected with it."

A CORRESPONDENT asks whether any of our readers can inform him if there exists any description of a fine section of Rhætic beds which is to be found about half a mile outside the town of Newark-upon-Trent?

WE have received copies of the *New York Tribune* for October 29, 30, 31, containing full reports of the recent meeting of the American Academy of Sciences, in New York. The reports are very detailed, and have evidently been prepared with great care for the *Tribune*, which, moreover, to judge from the numbers referred to, seems to devote something like one-third of its space to matters more or less connected with Science, not to mention literature. We fear this would not pay in this country; it evidently does in America. The American Academy, appears to be a kind of select upper Association for the Promotion of Science. It started with fifty members, and adds only five new members each year; there seems to be but little prearrangement as to the meetings.

THE earthquake on the 9th November, in Western Asia Minor, was rather remarkable. It was felt at 10 A.M. at the Dardanelles and Broossa. It reached to Ak Hissar, Phocæa, and the islands of Samos and Nisyros, in fact from N. to S. At Smyrna a first shock was felt at 9.49 P.M., and another at 3.20 A.M. [of the next day?]. After the first shock a strong smell of sulphur pervaded the atmosphere and entered the houses. A thick mist which had hung about for days dispersed, and the night was clear. Nisyros was supposed to be the centre. At the Dardanelles the shock was preceded by a rumbling noise. At Broossa there was a second shock at 1 P.M. An earthquake was felt on October 10, at 4.45 A.M., at San Salvador, in Central America. It was slight.

THE naturalists connected with the U.S. Yellowstone Expedition of the summer of 1873 have all returned from the field, and are at present engaged in preparing reports for transmission to the Secretary of War. The opportunities furnished by the occasion were not so good as had been hoped for, the region proving to be much more destitute of animal and vegetable life than anticipated. Everything was done, however, by them that the circumstances would allow. The collections embrace a full series of everything met with in the form of animal and vegetable life. The collections of butterflies and of plants were especially rich; of fossils not many were obtained, but among them will doubtless be found some new species. Among these was a large ammonite, 3 ft. in diameter, presented to the party by Lieut. P. H. Ray. A few uncharacteristic bones of fossil vertebrates were picked up, but the expedition failed to reach any of the great bone deposits of the Mauvaises Terres, as they had hoped to do.

We have recently had occasion to notice the fact that the plans of the new observatory at Cincinnati, U.S., had been approved, and were about being carried into execution. It gives us pleasure to record the rapid progress that has been made in this work, as evinced by the fact that on the 28th of August the corner-stone of the new building now in process of erection on Mount Lookout was laid with becoming ceremonies. The site chosen for the new observatory is about four miles north-east of that on Mount Adams, where the original observatory, founded by Prof. O. M. Mitchell, was established. The corner-stone that was laid in 1843 on that elevation by John Quincy Adams has been carefully removed to the new site, and appropriately forms the corner-stone of the new equatorial pier. The observatory has, by means of a tripartite agreement with the city and the heirs of Nicholas Longworth, now passed into the hands of the Cincinnati University. The proceeds, amounting to 50,000 dols., realised on the sale of the property on Mount Adams have been invested for the support of the art department of the university. The city, however, has pledged itself to maintain the observatory when once established, and the establishment has itself been hastened by the liberality of Mr. John Kilgour, who has given four acres of ground as a site for the new building, and added 10,000 dols. for the latter. The site is admirably adapted for the purpose of the institution. It is one of the highest points in the county, commanding a beautiful and extended view, and it is not likely that the difficulty experienced at the old site from the smoke and vapours of the city will for a long time if ever, trouble the astronomers on Mount Lookout. The new edifice faces south, having a width of about sixty feet, a depth of ninety feet, and two wings, making the breadth through the wings about one hundred feet. One of the wings will be used for the meridian instruments; and in the centre of the building, on a brick pier thirty-six feet high and seventeen feet in diameter, will rest the big telescope. The building will be two stories high, except in the centre, where the revolving turret of iron for the equatorial will add half a story. The structure is to be of pressed brick, with freestone trimmings.

The additions to the Zoological Society's collection during the last week include an Arabian Baboon (*Cynocephalus hamadryas*) from Arabia, presented by Miss Sandon; a Wild Cat (*Felis catus*) from Scotland, presented by Sir T. Riddell, Bart.; three Gray's Terrapins (*Clemmys grayi*), and some Moorish Tortoises (*Testudo mauritanica*) from Persa, presented by Hon. E. Ellis; an African Goat (*Capra hircus*) from Bedah, presented by Mr. J. A. Croft; a Macaque Monkey (*Macacus cynomolgus*) from India, presented by Lady Stirling; two Blue-throated Parrots (*Pionus sordidus*) from Venezuela; an Active Amazon (*Chrysotis agilis*) from Jamaica, and a Blackish Sternothere (*Sternothoerus subniger*) from Madagascar, purchased.

SCIENTIFIC SERIALS

The *Journal of Mental Science*, October 1873. This journal is still occupied with only medico-psychological subjects. The Morisonian Lectures on Insanity for 1873 begun in this number are of great interest, and mark the advance of Science in this painfully important branch of knowledge. Nothing, we think, can be more evident than that Dr. Skae proceeds on a scientific principle when he attempts to classify the various forms of insanity according to the bodily disease or condition, as far as it can be ascertained, which proceeds or accompanies the insanity. And it is surprising that even Dr. Maudsley should be found among those who cavil at Dr. Skae's classification, instead of adopting his principle and making the most of it. With insanity Science has made a beginning, but that is all.—In an article by Dr. J. T. Dickson on "The Functions of Brain and Muscle Considered in Relation to Epilepsy" we have a rather singular hypothesis concerning the functional relation of the brain to the muscular system. We cannot afford to indicate this curious theory; we doubt if we quite understand it; but we can inform the scientific world generally, on the authority of Dr. Dickson, that what they have been in the habit of believing on this subject "is not only improbable, but impossible." Dr. Hughlings Jackson has, it seems, been at the pains to quote against Dr. Dickson some passages from Herbert Spencer's Psychology; but he could have little known with whom he had to deal. Dr. Dickson quietly remarks—"From this it would seem that Spencer holds somewhat the same, though the untenable view." Was there ever a finer example of how completely original ideas can free a mind from the degrading thraldom of authority? Does Spencer differ from me? why then that is the worse for Spencer.—The article of most general interest is "The Morbid Psychology of Criminals," by Dr. D. Nicolson, continued from last number, and still unfinished. It abounds in valuable observations, and good practical common sense. When in prison criminals offer good opportunities for observation, but we do not perceive that their "emotional displays" can with strictness be said to mark anything specially morbid. From all that is said, we cannot gather more than that criminals are like the much larger class to which they generally belong, namely people of a low type of mind. The unfortunates that find their way into our prisons are, we regret to think, far from the only people who cannot help insanely acccusing others of wicked designs against them; whose minds are lawless and undisciplined; who must have their "breakings out;" and for whom, when they become intolerably insolent and violent, "a good drubbing on the spot" would be the most appropriate medicine. People, when inclined to what they ought not to do will not be deterred by the fear of punishments that are not painful, or which are too distant to act on their dull imaginations. This leads to large considerations, but we can only say that it would be a great matter for social progress if our tender-hearted philanthropists—those who busy themselves with theories of home, school, and prison discipline, distributing gratis wonderful receipts for the painless cure of all bad habits—could be brought to understand a little better than they do the real nature of the material on which they have to work. The review of the Lunacy Blue Books will be found interesting; also "Antiquarian Scraps relating to Insanity," by Dr. T. W. McDowall.

Journal of the Royal Geological Society of Ireland, vol. xiii., Part 3, for the session 1872–73, contains E. T. Hardman on the occurrence of gypsum in the Keuper Marls, near Coagh, Co. Tyrone.—Prof. T. Rupert Jones, on some Foraminifera from the chalk of the North of Ireland.—P. S. Abraham, notes on the geology of the Hartz.—Prof. Macalister, a description of two Veddah skulls, and Presidential address (which latter gives an able summary of the work done by German petrologists with the object of determining the mineral constitution and structure of plutonic, metamorphic, volcanic and other rocks by the aid of the microscope).—Prof. E. Hull, on the microscopical structure of the Limerick carboniferous Trap Rocks, and on the microscopical structure of Irish granites.—Col. Meadows Taylor, the Coal fields of Central India.—R. J. Cruise, Analysis of the Leitrim coal, remarks on the coal area of the district.—Dr. Studdert, on the Lough Allen coal from the Arigna District, Co. Leitrim.—G. H. Kinahan, on the carboniferous ingenite rocks of the County Limerick.—E. T. Hardman, on the occurrence of siliceous nodular brown Hæmatite (Göthite) in the carboniferous limestone beds near Cookstown, Co. Tyrone, &c., and on an analysis of white chalk from the County of Tyrone, with notes on the occurrence of zinc therein.—Rev. Dr. Macloskie, on the silicified wood of Lough Neagh.—Dr. Tichborne, on the formation of crystalline minerals having the spherical form.

The 2nd and 3rd numbers of the 7th volume of the *Canadian Naturalist* commence with a paper by Dr. Dawson on impressions and footprints of aquatic animals and imitative markings on carboniferous rocks, those considered being invertebrate. The paper originally appeared in *Silliman's Journal*.—Mr. G. F. Mathew continues a description of his impressions of Cuba, and enters into detail respecting the botany of the island.—Mr. Whiteaves gives an account of a deep-sea dredging expedition round the island of Anticosti, in the Gulf of St. Lawrence, in which upwards of 100 species of marine invertebrata new to the Gulf of St. Lawrence were added to the previously recorded fauna.—Dr. Dawson also contributes a paper on the geological relations of the iron ores of Nova Scotia, considering first the bedded ores of the Lower Helderberg series, and of Nictaux and Moose River; next the veins of iron ore of the East River of Pictou, Shubenacadie, and other parts.—Dr. Nicholson, of Toronto, describes some new fossils from the Devonian rocks of

Western Ontario, including *Zaphrentis fenestrata* (n.s.) *Blothrophyllum approximatum* (n.s.); *Heliophyllum colbornensis* (n.s.); *Petraia logani* (n.s.); and *Alecto canadensis* (n.s.).—A detailed report is given of the meeting of the American Association for the Advancement of Science, of which an abstract has already appeared in our pages.

Journal of the Franklin Institute, Oct. 1873.—We have here the second portion of Prof. Thurston's valuable paper on the molecular changes produced in iron by variations of temperature. He comes to the conclusion that at temperatures above 600° and below 70° F., iron conforms to the general law for solid bodies, that increase of temperature diminishes tenacity but increases ductility and resilience, while decrease of temperature has the opposite effect. Below 70° the tenacity increases with diminishing temperature at the rate of 0·02 to 0·03 per cent. for each degree F., while the resilience decreases in much higher ratio. Between ordinary temperatures and a point somewhere between 500° and 600°, on the other hand, iron shows marked deviation from the law, the strength increasing to the extent of about fifteen per cent. with good iron. The practical result is, that as iron does not lose its power of sustaining "dead" loads at low temperature, but greatly loses its power of resisting shocks, the factor of safety in structures need not be increased in the former case, where exposure to severe cold is apprehended; but that machinery, rails, and other structures which have to resist shocks should have large factors of safety, and be protected, if possible, from extremes of temperature.—Mr. Lowe communicates "something new concerning the physical properties of steam," viz., that the external work given out by steam in expanding from the temperature (t') to the temperature (t), bears a constant ratio to the difference; that is, to ($t' - t$). He considers the latent heat performs the internal work, while the sensible heat only is available for external work; in which lase that vapour whose latent heat is the smallest, other things equal, would be the best agent for converting heat into work.—A paper on statistics of coal, is compiled from Mr. James McFarlane's "Coal Regions of America."—Mr. Bilgram furnishes an "Elementary treatment of Zeuner's slide-valve;" and Mr. Murphy has a paper on "Bridge building considered normally."—There are descriptions of machinery for utilisation of coal waste, a stone-cutting machine, and a machine for making paper boxes. The latter produces match-boxes at the rate of 3,000 in an hour. Paste is dispensed with, the slips of wrapper being fastened by delicate staples of iron wire.

American Journal of Science and Arts, November, 1873. In this number we find two contributions in chemistry from the Massachusetts Institute of Technology, in one of which it is shown that by solution of cast-iron in an acid, there may be obtained, besides gaseous bodies, which escape with the hydrogen, volatile hydrocarbons, boiling between 93° and 155° C., and probably belonging partly to the saturated, partly to the non-saturated series. Of the latter, considerable quantities may be condensed by combination with bromine, after having passed through a freezing mixture.—Prof. H. L. Smith gives a series of investigations made in the Queen's Chamber of the Great Pyramid, as supporting the view that a high degree of geometrical and astronomical knowledge must have been possessed by the builders, but without superhuman accuracy. In a paper on rocks of the Helderberg era, in the Connecticut Valley, Prof. Dana endeavours to show that Staurolitic slate, hornblendic rocks, gneiss, mica schist, &c., are extensively developed in a *formation of Helderberg age*, and probably the Upper Helderberg or Lower Devonian. There is a letter from Dr. B. A. Gould, Director of the Cordoba Observatory (date Aug. 5), giving an account of work recently done there. Zone observations had been begun in September last year, and were nearly half completed, some 50,000 stars having been observed. From a note on the hypsometric work of the U.S. Geological and Geographical Survey of the Territories, we learn that four stations were established: at Denver, 5,000 feet above the sea; Cañon City, 6,000 feet; Fair Play (in the South Park), 10,000 feet; and Mount Lincoln, 14,000 feet; the observations at each being taken three times daily. The U.S. Signal Service have recently established a permanent meteorological station on the summit of Pike's Peak, about 14,000 feet high; the observations will be published daily by telegraph, and will doubtless be of high scientific and popular interest.—Of the remaining matter we may note suggested improvements in filter pumps, and in the arrangement of shutters in a dome for an equatorial telescope.

Poggendorff's Annalen der Physik und Chemie. No. 7. 1873. In this number, M. Quincke continues his "Optische Untersuchungen," investigating at some length the behaviour of polarised light on its passage through gratings.—M. Riess enunciates thus a new kind of reaction of currents: a wire circuit, part of which is traversed by a given (Leyden) battery current, remaining unaltered, various secondary currents, produced in it successively, react on the primary, so that the weaker secondary corresponds to the stronger primary.—Dr. Voller has examined the influence of temperature on electromotive force of galvanic combinations, and finds that with salt solutions in contact with copper or zinc, the force is diminished by rise of temperature, whereas with acids it is increased.—An interesting paper by Prof. Villari treats of the time flint glass takes to be magnetised, demagnetised, and to turn the plane of polarisation. He rotated a glass cylinder between the poles of an electro-magnet, where it acted like a cylindrical lens to polarised light passing through the poles. When not magnetised, the cylinder, whether in motion or at rest, was neutral to the light; but when magnetised, its plane-rotating power considerably diminished with increasing velocity of rotation; the reason being that, in such quick revolution, each diameter remained too short a time in the axial direction to acquire all the magnetism it would otherwise have. To give flint glass such diamagnetic intensity, as became observable by rotation of the plane, required at the least 0‴001244, while to give it all the diamagnetism it is capable of taking under a strong magnet, at least 0‴00241 was necessary.—"A contribution to the theory of thermal currents," by M. Avenarius, appears to be an appropriation of results published by Prof. Tait in 1870, and which are incorporated in the professor's Rede Lecture for this year. A similar remark will apply to M. Topler's application of air-friction to the deadening of galvanometer needles, &c., which is simply Sir W. Thomson's dead-beat principle.—M. Raye criticises unfavourably M. Zöllner's theory of sun-spots and protuberances; his own theory represents, in the sun, something like what occurs in our cyclones, in which there is an *upward* air-current carrying with it aqueous vapour, which forms above into a cloud. He thus differs from Faye, who supposes a *descending* current, in the solar cyclones.—M. Hennig describes an apparatus for quantitative spectrum analysis, and M. Schneider continues his account of salts of sulphur. We find also notes on galvanic reduction of iron under the influence of an electromagnetic solenoid, and on the reflection and refraction of sound; from the St. Petersburg and Vienna academies respectively.—An abstract of an instructive paper by M. Vogel on the spectra of comets we hope to give shortly.

SOCIETIES AND ACADEMIES

London

Geological Society, Nov. 19.—Prof. Ramsay, F.R.S., vice-president, in the chair.—The following communications were read:—"Supplemental Note on the Anatomy of *Hypsilophodon Foxii*," by Mr. J. W. Hulke, F.R.S. The material for this note was a slab from Cowleaze Chine, containing portions of two individuals of *Hypsilophodon Foxii*, one consisting of a skull with a great part of the vertebral column, the other of a portion of the vertebral column. The author described some details of the structure of the skull, and especially the palatal apparatus. In connection with the question of the generic rank of *Hypsilophodon*, the author stated that in *Hypsilophodon* the centra of the sacral vertebræ are cylindroid and rounded below, whilst in *Iguanodon* they are compressed laterally and angulated below.—"The Drift-beds of the North-west of England, Part 1, Shells of the Lancashire and Cheshire Low-level Clay and Sands," by Mr. T. Mellard Reade. The author gave a list of the localities in which shells were found, and stated that in all forty-six species had been met with distributed through the clay-beds, those found in the sand-seams being rare and generally fragmentary and rolled. He contended that the admixture of shells in the boulder-clay was due to the tendency of the sea to throw up its contents on the beach, whence changing currents and floating ice might again remove them, and to the oscillations of the land bringing all the beds at one time or another within reach of marine erosive action. He maintained that it is in the distribution of land and sea at the period of deposition of the Lancashire deposits, and not in astronomical causes, that we must seek the explanation of the climate of that period, the conditions of which he endeavoured to explain by a consideration of the proportions of the species and the natural habitats of the shells found in the drifts.—"Note on a deposit of Middle Pleistocene Gravel near Leyland, Lancashire," by Mr. R. D. Darbishire. The bed of gravel, about forty feet thick, and about 240 feet above the level of the sea, is covered by yellow brick clay, and overlies an untried bed of fine sea-sand. The shells and fragments occur chiefly at the base of the gravel. The author considered the Leyland deposit, like those on the west of the Derbyshire hills, to be more probably littoral and truly climatic than that of the Liverpool clays, the subject of Mr. Reade's paper, and hazarded the conjecture that the latter were sea-bottom beds, into which, during some process of degradation and redistribution, the specimens found and enumerated by Mr. Reade had been carried down from the former more ancient retreating coast-lines.

Geologists' Association, Nov. 7.—Mr. Henry Woodward, F.R.S., president, in the chair.—At this, the first meeting of the session 1873-74, the president delivered the opening address of the new session, in which he gave a review of the progress of geological science during the past year. Mr. Woodward referred to the progress made in the acceptance by botanists and zoologists of the doctrine of evolution. "Darwin's theory has already passed through the fire like crude ore, it has been roasted, crushed, sifted, washed, and after all the pure metal remains. Our speculations, however, bring us no nearer to the discovery of the origin of life itself."

Meteorological Society, Nov. 19.—Dr. R. J. Mann, president, in the chair.—The following papers were read:—The thunderstorm at Brighton on Oct. 8, 1873, and its effects, by F. E. Sawyer, and some considerations suggested by the depressions which passed over the British Islands during September 1873, by F. Gaster.—A discussion took place on the best form of thermometer stand. It was resolved that the following conditions should be fulfilled:—(1) The contained thermometers must at all times be shielded from the direct rays of the sun; (2) The stand must be so arranged that even when its own external temperature is raised, the thermometers shall not be thereby affected; (3) As reflected heat must diminish the accuracy with which thermometers indicate air or shade temperature, these disturbing causes should be excluded; (4) The temperature of the air alone being desired, it is necessary that the readings of the thermometers be not affected by radiation to the sky; (5) It being desirable that one pattern of stand be used in all localities, it follows that it should be absolutely independent of all surrounding objects; (6) There must be free access of air round the thermometers; (7) No rain should ever reach the dry-bulb thermometers, for if it does, it improperly lowers their temperature, making them read even lower than the wet bulb; (8) The stand must also be unaffected by snow, both as a direct fall or from obstructed circulation of air; (9) It is very desirable that the stand require no attention between the hours of observation; (10) It is desirable, but not absolutely necessary, that room be provided for a duplicate set of instruments; (11) The stand should not be costly; (12) It should be capable of easy transmission by rail or otherwise. Mr. Prince gave an account of some experiments he had made, and was of opinion that the true temperature of the air could be obtained without a stand. Mr. Symons thought that a stand constructed on the Kew and Stevenson pattern combined, but smaller than the former and larger than the latter would be the best form of stand to adopt. The meeting not having the results of the comparison of the observations made with the different stands at Strathfield Tungiss, the discussion was adjourned till after these are published.

Anthropological Institute, Nov. 25.—Prof. Busk, F.R.S., president, in the chair.—Mr. F. W. Rudler read a report on Anthropology at the meeting of the British Association at Bradford.—Dr. G. W. Leitner, Principal of the Government College of Lahore, gave an account of the Siah Posh Kafirs, a race of people inhabiting Kafiristan, on the south-eastern slope on the Hindu Kush. Kafiristan may be said to form a triangular tract of country lying between 35° and 36° N. lat., and 70° and 72° E. long., and is bounded on its sides by Kábul, Badakshan, and Kashmir. The name of Siah Posh Kafirs was given to them by the Mohammedans, "Siah" meaning "black," "Posh" clothing, and "Kafir" infidel; for in fact a Kafir, according to the Mohammedans, was any one who did not follow the teaching of Mahomet. The Kafirs claimed to be a sort of country cousins of the British. Slavery existed within their own country, and also within five miles of Peshawur, where the Kafirs were sold in the open market. The consequence was that the Kafirs in retaliation, kept the roads leading to Central Asia in a state of insecurity, and murdered all travellers coming within their reach. Dr. Leitner, referring to the asserted Macedonian origin of the Kafirs, said that that supposition was founded on very loose and vague data, and that they themselves knew nothing of Alexander. The Tunganis, another of those races, claimed direct descent from Alexander's soldiers. Another theory was that the Siah Posh Kafirs were Zoroastrians, who were supposed to have been forced into the hills by the Arabs, and the existing customs among the Kafirs certainly seemed to support the idea that they were ethnologically connected with the Parsees. He inclined to the opinion that they were Aborigines; and if they were not descended from the same stock as the "Arian" race, they were certainly, as far as language was concerned, equally related to the Sanscrit.

Entomological Society, Nov. 17.—Prof. Westwood, president, in the chair.—Mr. Higgins exhibited *Deilephila euphorbiæ* and *Sphinx pinastri*, bred from larvæ taken in June 1872, near Harwich.—Mr. Champion exhibited several rare Coleoptera taken at Braemar and other places during the past season.—Mr. Boyd exhibited a Trichopterous insect, *Brachycentrus subnubilus*, a species which constructs quadrangular cases, which had been reared from the egg state.—Mr. Müller remarked on some galls found by Dr. Masters on the roots of *Deodara*, which he considered identical with the galls of *Biorhiza aptera*, Fab., usually occurring on the roots of oak.—Mr. Bird exhibited *Chilo gigantellus* from Horning Fen, and Mr. Vaughan *Pempelia davisellus* reared from Furze.—Mr. Stevens exhibited some rare Lepidoptera taken on the South Coast.—A paper was read, entitled "Notes on the Habits of *Papilio merope* Auct., with a Description of its Larva and Pupa," by J. P. Mansel Weale, B.A. Also a paper entitled "Observations on *Papilio merope* Auct., with an account of the various known Forms of that Butterfly," by Roland Trimen, F.L.S., &c.—Some remarks were communicated by Mr. Miskin, of Brisbane in Queensland, respecting *Mynes guerini* of Wallace, which he considered identical with *M. geoffroyi* Guerin, and directing attention to the singular habit of the pupæ, which were suspended in groups of three or four individuals, united at the tails.

Royal Horticultural Society, Nov. 12.—Scientific Committee.—A. Grote, F.R.S., in the chair.—The Rev. M. J. Berkeley sent a Capsicum from Transylvania with two small fruits produced from the placenta.—Mr. Anderson Henry sent fruit of *Tacsonia quitensis*, produced in a cool greenhouse.—Mr. Wheble sent wood and bark of *Sequoia sempervirens*, the latter being extremely similar to that of the large tree exhibited at the Crystal Palace.—Prof. Thiselton Dyer exhibited preparations of the buds upon the leaves of *Malaxis*, prepared by Prof. Dickie.

General Meeting.—H. Little in the chair.—Prof. Thiselton Dyer called the attention of the meeting to the fine plant of *Vanda cærulea* with four panicles; a plant of the recently introduced *Batemania Burtii* from Costa Rica; specimens of a species of *Stylidium* (probably *S. ciliatum*), an Australian genus with the radical leaves in a Crassula-like tuft; flowering specimens of *Cunonia capensis* from Syon House; and a "grape-rail," a contrivance by which grapes could be preserved through the winter. The pieces of cane to which the grapes were attached were inserted into holes in long zinc rod-like boxes which contained a mixture of fuller's earth, starch, sugar, charcoal, and water. It was remarked by Mr. Jennings that *Vanda cærulea* was fast disappearing from its native localities. At the present rate the ruthless removal of the plant must determine its extermination at any rate in the Khasia hills.

Anthropological Society, Nov. 18.—Dr. R. S. Charnock, president, in the chair. Extracts from letters from foreign correspondents were read, one of which announced an alleged discovery of a Phœnician inscription of the 4th century, B.C., near Rio de Janeiro, and one from Captain Burton, mentioning the discovery at Maeshowe, in Orkney, of Scandinavian inscriptions, in Arabic letters.—Personal observations of the Sae-lies or Flathead Indians of North America, by J. Simms, M.D., of New York The discourse treated of the manner of fashioning or deforming the head, the customs, dress, diet, disposition of the dead, &c. Dr. Simms also gave a brief description of the Quatsino Indians, who inhabit the north-western coast of Vancouver Island, the mode of fashioning their peculiar, sugar-loaf form of heads, their superstitions, food, &c. He also gave a very interesting account of the Digger Indians of California, the ircolour, form, dress, manner of living, general habits, including badges of mourning, food, &c. The Snakes, Utes, Piutes, Foxes, Sioux, and other tribes were briefly described.

CAMBRIDGE

Philosophical Society, Nov. 17.—"On a suspected forgery in the Vatican Manuscript Record of the Trial of Galileo before the Inquisition," by Mr. Sedley Taylor, late Fellow of Trinity College. The object of the paper was to show, in accordance with the views of recent German and Italian authorities, that the sentence pronounced against Galileo in 1633 was based on a spurious document fabricated for the express purpose of securing his condemnation. The evidence adduced to support this conclusion was taken partly from the works and letters of Galileo, and partly from the contemporary records of the trial preserved in the Archives of the Inquisition, portions of which have been lately published for the first time. The result of the paper was to exonerate Galileo completely from the charge of contumacy which all his biographers have hitherto either advanced or tacitly admitted.

MANCHESTER

Literary and Philosophical Society, Nov. 4.—R. Angus Smith, F.R.S., vice-president, in the chair.—"On the Bursting of Trees and Objects struck by Lightning," by Prof. Osborne Reynolds, M.A. The results of the experiments referred to in this paper were exhibited to the meeting. The suggestion thrown out by Mr. Baxendell at the last meeting—that the explosive effect of lightning is due to the conversion of moisture into steam—seemed to him to be so very probable, that he was induced to try if he could not produce a similar effect experimentally. He tried various experiments by sending a discharge through pieces of damped wood, and through glass tubes with and without water. The pieces of wood, which varied in size, yielded various results, and the glass tubes, which also were of various sizes, were shivered to pieces.—The Rev. W. N. Molesworth, M.A., brought under the notice of the Society some Roman and Celtic antiquities, to which he thought that sufficient attention had not been given in this country.

Nov. 18.—E. W. Binney, F.R.S., vice-president, in the chair.—"On the Bursting of Trees and Objects struck by Lightning," by Prof. Osborne Reynolds, M.A. In a paper on this subject read at the last meeting I stated that the tube which was burst by a discharge from a jar would probably withstand an internal pressure of from 2 to 5 tons on the square inch; and I made use of the expression the tube might be fired like a gun without bursting. These statements were based on the calculated strength of the tube, and with a view to show that there was no mistake, I have since tried it in the following manner.—I made 3 guns of the same tube. No. 1, which was 6 inches long, had its end stopped with a brass plug containing the fuze hole. No. 2 and No. 3 were 5 inches long and had their breeches drawn down so as only to leave a fuse hole. These tubes were loaded with gunpowder and shotted with slugs of wire which fitted them, and which were all $\frac{3}{4}$ inch long. No. 1 was first fired with $\frac{1}{2}$ inch of powder, the shot penetrated $\frac{1}{4}$ inch into a deal board, and the gun was uninjured. No. 2 was then fired with $1\frac{1}{2}$ inches of powder, and the shot went through the 1-inch deal board and $\frac{1}{2}$ inch into some mahogany behind, thus penetrating altogether $1\frac{1}{2}$ inches; the tube, however, was burst to fragments. Some of these were recovered, and although they were small they did not show cracks and signs of crushing like those from the electrical fracture. No. 3 was then fired with $\frac{3}{4}$ inch of powder, and the shot penetrated $\frac{1}{2}$ inch into the deal board. It was again fired with 1 inch of powder, and the shot penetrated 1 inch into the deal. Again it was a third time fired with $1\frac{1}{4}$ inches of powder, when it burst, and the shot only just dented the wood. These experiments seem to me to prove conclusively the great strength of the tube and the enormous bursting force of the electrical discharge.—On the colour of Nankin cotton by Edward Schunck, Ph.D., F.R.S.—An improved method for preparing Marsh Gas, by C. Schorlemmer, F.R.S. The author found that by heating an intimate mixture of anhydrous sodium acetate with more than twice its weight of lime and sodium carbonate, a very regular and quiet evolution of marsh gas took place. The gas thus obtained always contains some acetone, which is easily removed by shaking it with water, or, better still, with a solution of acid sodium sulphite.

DUBLIN

Royal Geological Society of Ireland, Nov. 12.—Prof. E. Hull, F.R.S., president, in the chair.—Mr. J. E. Gore, C.E., read a note on a bed of fossiliferous kunkar in the Punjab—The president read a series of notes on the Microscopic Structure of Irish Granites:—1, Granite of Aillemore, Co. Mayo; 2, Granitoid Quartz Porphyry of Attithomasreagh, Co. Galway; 3, Granite of Ballynockan, Co. Wicklow.—Prof. Reynolds exhibited specimens of the new minerals Uranotine and Walpurgine.—Prof. Traquair exhibited specimens for the Rev. J. Emerson, of some coal fossils from the Jarrow Colliery, Co. Kilkenny, among which were noticed portions of the skeletons of *Urocordylus wandesfordii* and *Ichthyerpeton bradleyi* described some time since as from a neighbouring colliery, by Huxley and Wright; also the palate tooth of *Ctenodon cristatus*, patches of scales of *Megalichthys hibberti*, and some vertebræ and scales of a Rhizodopsis.

Royal Irish Academy, Nov. 10.—Rev. Prof. Jellett, president, in the chair.—A paper was read by Messrs. Draper and Moss on some forms of Selenium, and on the influence of light on the electrical conductivity of this element.—Prof. Macalister read a paper on the anatomy of a species of Aonyx from the Upper Indus. The species had been sent by the late Earl of Mayo to the Royal Zoological Society of Ireland, but differed in no marked degree from the one described by Horsfield as *A. leptonyx*.—Mr. H. W. Macintosh read a paper on the myology of *Arctopithecus blainvillii*.

EDINBURGH

Royal Society of Edinburgh, Dec. 1.—Sir Robert Christison, vice-president, in the chair.

The following communications were read:—

1. Laboratory Notes, by Prof. Tait.—(1) First Approximation to a Thermo-electric Diagram. (2) On the Flow of Water through Fine Tubes.

2. Note on the use of ∇ in Curvilinear Co-ordinates, and on the Transformation of Double and Triple Integrals, by Prof. Tait.

2. On the Physiological Action of Ozone, by James Dewar and Dr. M'Kendrick.

4. On a Compound formed by the addition of Bromacetic Acid to Sulphide of Methyl, and on some of its Derivatives, by Prof. Crum Brown.

5. Note on the Expression for the Action of one Current-element on another, by Prof. Tait.

GLASGOW

Geological Society, Nov. 13.—Mr. E. A. Wünsch, vice-president, in the chair. A paper on the Post-tertiary Beds (Kyles of Bute), by the Rev. H. W. Crosskey and David Robertson, was read to the meeting. The succession of beds, as found at various parts of the Kyles, in proceeding from high to low water mark, is as follows:—(1) Boulder-clay, hard, compact, unfossiliferous, and red in colour; (2) A highly laminated clay, precisely similar to that which occupies the same position at Paisley and many other localities, has been found to contain the remains of some species of Foraminifera; (3) A bed of clay and sand, exceedingly rich in characteristic Arctic shells; (4) The *Pecten maximus* bed, has been fonnd cropping out in various localities.—Mr. Jas. Armstrong read a paper on the Fossils found in the Carboniferous Shales of Gare and Westerhouse, illustrated by a series of finely-preserved specimens collected from these localities, about three miles to the north-east of Carluke.—The Chairman exhibited some interesting specimens of the junction of granite and slate from the island of Arran, and made some remarks on the various theories which had been propounded regarding its origin.

CONTENTS

PAGE
DR. MEYER'S EXPEDITION TO NEW GUINEA. By Dr. A. B. MEYER . 77
MICROSCOPIC PETROGRAPHY . 79
OUR BOOK SHELF . 81
LETTERS TO THE EDITOR:—
The Southern Uplands of Scotland.—Prof. A. GEIKIE, F.R.S. . 81
The Huemul.—Dr. BURMEISTER . 82
The Diverticulum of the Small Intestine considered as a Rudimentary Structure.—Prof. STRUTHERS . 82
The Atmospheric Telegraph.—R. S. CULLEY . 83
SENSATION IN THE SPINAL CORD. By G. H. LEWES . 83
THE ARTISTIC REPRESENTATION OF NATURE. (*With Illustration*) . 84
ON THE SCIENCE OF WEIGHING AND MEASURING, AND THE STANDARDS OF WEIGHT AND MEASURE, IX. By H. W. CHISHOLM, Warden of the Standards (*With Illustrations*) . 87
EARTH-SCULPTURE, II. By Prof. A. GEIKIE, F.R.S. . 89
NOTES . 91
SCIENTIFIC SERIALS . 93
SOCIETIES AND ACADEMIES . 94