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NATURE

THURSDAY, DECEMBER 11, 1873

THE ARCTIC EXPEDITION

WE were able to announce, in our last number, that the version of the reply of the Government with regard to the despatch of an Arctic Expedition, which had appeared in the daily newspapers, was inaccurate, and that the subject was still under consideration. But the grounds for abandoning Arctic discovery, which were attributed to the Government, have no doubt occurred to the official mind; and they involve fallacies which would be so fatal to the best interests of this country, that we cannot allow them to pass without remark.

It was said that the Government hold that survey operations have a stronger claim than those of discovery; and that if Ministers were inclined to augment charges for such purposes, they would incline to do so for survey, rather than for a new voyage of discovery.

We have here an attempt to separate scientific expeditions into two branches, survey and discovery. The originator of this fallacy does not appear to be aware that all surveying voyages are voyages of discovery in the strictest sense. Their operations are intended to explore, and accurately lay down, unknown or little known coasts or harbours. Captain Cook's voyages were surveying operations, and it will scarcely be denied that they were also voyages of discovery. The Arctic voyages of Ross and Parry included surveys which have been of the utmost value to the whaling fleets ever since.

Arctic discovery is now advocated by naval and scientific men for the very reason that it will include marine surveys and hydrographical investigations of the most undoubted importance. Few operations have "benefited commerce and promoted international intercourse" more than Arctic voyages of discovery. One of our earliest Arctic expeditions discovered the White Sea route to Russia, and opened a flourishing trade. The Spitzbergen voyages led to the establishment of a fishery which added millions to the wealth of these islands. The discovery of Davis's Straits did the same. Ross's first voyage showed the way for the whalers into Baffin's Bay. Parry's voyages pointed out new ground in Prince Regent's Inlet. The handling of steamers by Osborn and Cator, as Capt. Penny declared at the time, caused a revolution in the system of ice navigation by whalers. Arctic voyages are surveying operations, and they have benefited commerce as much as any other surveying work whatever. As to promoting international intercourse, Arctic achievements have always excited friendly sympathy and interest throughout the civilised world.

We must also notice the shocking insincerity of the reply that is imputed to the Government. An Arctic Expedition cannot be undertaken, we are told, because Ministers are anxious to provide funds for ordinary surveys. Now it is a fact that no Government has ever more persistently neglected the surveying branch of the service; which has been so starved and pared down as to cause anxiety to those acquainted with the subject. If the Hydrographer's official position did not seal his lips, he could give an account of the way in which the surveying department has been treated of late years, which would excite indignation throughout the country. Some idea may, however, be obtained of the way in which surveys are neglected, from the following figures. From the year 1849 to 1853, the proportion of each 1000*l*. of naval expenditure spent on surveying averaged 15*l*. 5*s*. It is now 9*l*. In 1871—72 the total effective naval expenditure was 7,807,946*l*., and the expenditure on the surveying branch was 70,456*l*. The total tonnage of the British mercantile marine in 1871—72, was 7,142,894, so that the total naval expenditure per ton of British naval shipping, was 1*l*. 1*s*. 11*d*.; and the proportion of expenditure for surveying and discovery, by far the most useful and important work of the navy in time of peace, was 2*d*. Not only has surveying and Arctic work been rendered inefficient by extreme parsimony, or wholly neglected; but, while the wealth of the country has enormously increased, the expenditure on the best work of the navy has been cut down to a third less than it was twenty years ago.

It may be that the official notion of surveying is confined to the revision of work on comparatively well-known coasts. Even such work is done inefficiently; and its renewed efficiency would be no argument for the neglect of Arctic exploration. At the time when Arctic expeditions of discovery were despatched, the more ordinary surveying operations were not neglected Officers were surveying the coasts of these islands, Capt. Graves was at work in the Mediterranean, Collinson in China, Kellett in the Pacific, and their vessels were properly equipped. Assuredly the Government are bound to restore the Surveying Department to efficiency; and such a reformation would include the despatch of a thoroughly well-equipped Arctic Expedition for survey and discovery. We understand that a further most able and carefully-considered letter has been addressed to Mr. Gladstone on this subject; and we earnestly trust that, after further consideration, the Prime Minister will see that his plain duty points in the same direction as political expediency. The country feels strongly on the subject; and the resolution to despatch an Arctic Expedition of discovery in 1874, will meet with the hearty approval of all classes of the community.

LOCAL SCIENTIFIC SOCIETIES *
III.

IN the ten years succeeding 1860 the number of local scientific societies formed throughout the country was more than double that of the previous decade, amounting altogether to fifty-six, of which no less than forty-five are field-clubs. Many of these are well known for producing excellent work, but we must refer our readers to the list at p. 521 of vol. viii. for details. The Quekett Club of London was formed during this period, as were also a number of clubs in the Severn Valley, the Eastbourne Natural History Society, and others which have done good work, but which are far too numerous to mention. Two or three very excellent societies were formed in North Britain during this decade, including the Perthshire Society of Natural History, which, at any rate as represented by a few of its members, is one of the hardest-

* Continued from p. 40.

working societies in the kingdom. Under its auspices the *Scottish Naturalist* is published, and a *Flora* and *Fauna* of the extensive and varied county of Perthshire is being brought out; recently we noticed a proposal issuing from one of the members for the establishment of a British Naturalists' Agency. A very laudable though somewhat Scotch appendage has just been added to the Society, in the shape of a "Perthshire Mountain Club" for the exploration of the Perthshire mountains, more especially those that have been neglected by naturalists, with the following office-bearers:—A cairn-master, a scribe and naturalist, a geometer, a bard, and, to crown all, a quaigh-bearer, a quaigh being a two-eared drinking-cup from which to quaff the "mountain-dew" withal.

Another Scottish club that we deem worthy of special mention is the Alva Society of Natural Science and Archæology, whose history has been one of continued success. There can be no doubt, the secretary informs us, that this Society has tended to foster a taste for natural history in the neighbourhood, and encouraged the observation of local phenomena. It was founded in 1862, and now numbers 110 members belonging to all classes of society; the patron being the Earl of Kellie, the president the sheriff-substitute of the county, the vice-presidents a medical practitioner, a grocer, and a wine-merchant; the councillors a clergyman, a bank agent, a hairdresser, an architect, and an ironmonger; the treasurer a druggist, the secretary a medical practitioner, the curator a blacksmith, and the librarian the governor of the prison. The object of the Society is the study of natural science and archæology by the exhibition and preservation of specimens, the reading of communications, by lectures, excursions, and the formation of a library and museum. The number of members has become so large, and the collections of the Society have so accumulated, that their present place of meeting has become too small, and the Society has therefore contracted to have a special building erected for its own use, at a cost of about 1,600*l.*, raised by subscription from among the members and the noblemen and gentlemen of the neighbourhood. The papers read at the monthly meeting are printed in one of the local papers, the type being afterwards broken into pages, and a small volume of transactions thus published for each year. One of these volumes we have before us, and its contents are varied and exceedingly creditable, though we miss a list of the fauna and flora of the small county of Clackmannan, in the county town of which the Society has its head-quarters. We hope this excellent Society will make the compilation of such lists part of its work in the future.

Our space only permits us to name the Largo Field Naturalists' Society, on the north shore of the Frith of Forth, a society founded in 1863, and which, to judge from the papers read and the secretary's report to us, is doing excellent service in connection with the natural history of the county of Fife; it appears to have a valuable collection of specimens. We mention these three societies because, in some respects, they are worthy of imitation by other similar associations, and because, we regret to say, Scotland is not represented in the list of field-clubs in anything like the proportion, even considering its size, that England is; very large districts, which we are sure would yield abundant fruit of a rare and interesting kind, being entirely unworked by any club. We hope in the course of a very few years to see this defect remedied.

In the three years 1871-2-3, at least twenty-seven new societies have been formed; there may have been more of which we have not heard. Fourteen of these have had their origin during the present year; and if field-clubs continue to multiply during the remaining years of the decade in the same proportion, we may expect to see very few districts in England and Scotland at least, without its local field-club. We had hoped that the inquiries of the British Association Committee on this subject might have given an additional impetus to the spread, as well as to the usefulness, of such societies; but we fear that hitherto this committee has done absolutely nothing.

We cannot conclude this part of the subject without referring to the field-clubs of Lancashire and the west of Yorkshire. In Lancashire there are a number of field-clubs * composed almost exclusively of working-men, some of which have been in existence for many years, and all of them, we believe, in excellent working condition. In Lancashire there are at least eleven of such clubs, one of which is among the most efficient field-clubs in the kingdom. This is the Todmorden Botanical Society, which may be taken as a specimen of these Lancashire clubs, and of which Sir Walter Elliot thus speaks:—

"One of the most successful of the above is the Todmorden Botanical Society, established in 1852, principally through the exertions of Mr. Stansfield, who has always been its president. The bulk of the 185 members are working-men, who pay a subscription of 6*s.* a year, meet on the first Monday of every month, and in the winter, on the intermediate fortnights, for lectures and papers; and make six field excursions, four within ten miles, and two longer ones, extending into neighbouring counties, and even as far as Scotland. They have a good herbarium, and have prepared a flora embracing a space of six miles round Todmorden. They have also acquired a library of 600 volumes, chiefly botanical."

We can only briefly refer to the West Riding Consolidated Naturalists' Society, which at present, as will be seen from our list, consists of an amalgamation of twelve local clubs, belonging to various towns in the West Riding, and all of them, like the Lancashire Societies, composed mainly of working-men. Each of these societies has, we understand, its own district in which to carry on its field-work, and the united societies have stated meetings, but so far as we have ascertained, they have not yet decided upon a satisfactory *modus operandi.* The amalgamated societies have, however, a journal in common, "The Yorkshire Naturalists' Recorder," in which their proceedings are published, we believe monthly. There is no doubt that if their united societies could devise a satisfactory organisation in which to carry on their work in co-operation, great good would be the result. Their example might, we think, be followed with advantage by other contiguous small societies, which we fear are often apt to get disheartened from the paucity of working members, and a feeling of isolation. This is

* We regret that these were omitted from our list, as we got no information from them, and Sir W. Elliot does not give them in his list, only referring to them for some reason in his address.

the only instance, so far as we know, in which a number of contiguous societies have united into a connected group, though other societies occasionally have excursions in common.

We regret to say that since our list was published, we have ascertained that two of the Yorkshire Societies named therein, are now defunct, viz. the Halifax Naturalists' Society, once a member of the West Riding Union, and the Leeds Natural History Society. We have been told that the Wigan Field Naturalists' Scientific Society, given in Sir Walter Elliot's list, with 150 members, is also dead. We hope that in reality these are not dead, but only sleeping; and that means may soon be taken to rouse them again into activity.

Altogether, then, including the Lancashire Societies not in our list, and others of which we have heard since our list was published, one of which was founded at Ballymena, County Antrim, the result, we believe, of some lectures there last winter, there are at the present time in Great Britain and Ireland at least 169 associations established solely or partly for the pursuit of science in one form or another. Of these 104 are professedly field-clubs, while a considerable number of the remainder do field-club work in so far as the publication of lists of the natural productions of their surrounding districts are concerned. Only 22 of these 169 societies were founded previous to 1830, while all the field-clubs were formed after that year, and by far the greater number of them within the last twenty-three years. We do not reckon among these the scientific societies which have been formed in connection with our public schools, to which we shall refer afterwards.

Of these societies the English ones are mainly grouped in the North of England, along the Welsh border, and in the southern counties, the midland district being but sparsely represented, and Bedfordshire,* Derbyshire, Essex, Hertfordshire, Huntingdonshire, Lincolnshire, Rutlandshire, not at all, not to mention the Channel Islands and the Isle of Man, which would afford opportunities to field-clubs which cannot be attained in the main island at all. Glamorganshire is the only Welsh county represented by a society, while all but three of the Irish counties are unrepresented. Scotland, the birthplace of field-clubs, we have already referred to as being far behind England in this respect. Ireland, and even Wales, cannot perhaps at present be blamed for their backwardness in regard to associations of this kind, though each country, in its own way, offers a magnificent field of investigation to local naturalists. With regard to the unoccupied districts of England and Scotland, we can only hope that the scientific contagion may rapidly spread, as no doubt it will when all the conditions are present for its taking effect. Meanwhile, the rapid spread of scientific societies, and especially field-clubs, and the valuable results that have already followed from the labours of a number of them, must be exceedingly gratifying to all who desire to see the triumph of science, and, indeed, to all who are earnestly seeking after the elevation of their fellow-men. Is it not one more sign that "the old order changeth, yielding place to new?"

* By a misprint in our last article the Woolhope was said to be in Bedfordshire instead of Herefordshire.

MARSHALL'S TODAS OF SOUTH INDIA

A Phrenologist amongst the Todas; or, the Study of a Primitive Tribe in South India. By William E. Marshall, Lieut.-Col. of H.M. Bengal Staff Corps. (Longmans, 1873.)

THE Todas are a pastoral hill-tribe in the Nilagiri region of Southern India, whose singularly interesting social condition fairly entitled them to be described in a volume by themselves. Colonel Marshall succeeds in communicating to his readers the lively interest he felt in his work, and several points of ethnology will be perceptibly advanced by it, notwithstanding much of the theoretical part of the book which will hardly meet with acceptance.

Especially from the moralist's point of view, the condition of these secluded herdsmen deserved to be put on record while still little changed under influences from without. They show perfectly how the milder virtues naturally prevail among men in an intellectually childlike state, if only society is undisturbed from without, and finds its equilibrium within. "The general type of the Toda character is most unvarying; singularly frank, affable, and self-possessed, cheerful yet staid;" theft and violence are almost absent among them; their quiet domestic life is "undisturbed by the wrongs of grasping, vindictive, overbearing natures;" their engagements to support their wives and children, though resting on mere promises, are kept through utter guilelessness and want of talent to plot. Toda society is simply held together by the strength of family affection. "It is a quiet, undemonstrative, bu intensely domestic people; domestic in the wider sense of viewing the entire family, to the last cousin, much as one household, in which everyone is everywhere entirely at home; each one assisting, with the steadiness of a caterpillar, in the easy, progressive task of emptying his neighbour's larder; no one exerting himself by one fraction to raise the family. The great feature in Toda organisation, is the all-absorbing power of his domestic attachments, which, like Pharaoh's lean kine, swallow up all other qualities." The points where the moral code of these easy-going folk differs from that of modern intuitive moralists, are especially polyandry and infanticide. Their marriage-relations within the family have perhaps more nearly approached than those of any other known tribe that promiscuity which several modern ethnologists have supposed to belong to a primitive state of society; "it was formerly their almost universal custom—in the days when women were more scarce than they are now—for *a family of near relations to live together in one mand, having wife, children, and cattle all in common.*" Here, indeed, is socialism of an extreme order, prevailing among a low race, in whose general condition its evi and good are alike visible. As need hardly be said, to the Toda mind polyandry seems part of the natural order of things. So it was with infanticide, till about fifty years ago an English officer, Mr. Sullivan, mounted the Nilagiri plateau and visited the homes of the Todas. Since then all the events of Toda history have been dated from the visit of "Sullivan Dore," as we date from the Christian era, and thenceforward the Government put down infanticide, and its former prevalence is now only to be traced in the census, and learnt from the memory of old people.

An aged Toda gave his account of the practice :—"I don't know whether it was wrong or not to kill them, but we were very poor, and could not support our children. Now every one has a mantle ('putkuli'), but formerly there was only one for the whole family, and he who had to go out took the mantle, the rest remaining naked at home, naked all but the loin-cloth ('kuvn'). We did not kill them to please any god, but because it was our custom. The mother never nursed the child—no, never! and the parents did not kill it. How could we do so? Do you think we could kill it ourselves? Boys were never killed, only girls; not those who were sickly and deformed—that would be a sin ('papum'); but when we had one girl, or in some families two girls, those that followed were killed."

Perhaps the ablest part of Colonel Marshall's work is his tracing out of the social forces which brought about this condition of society, the enforced equilibrium between population and means of subsistence, leading a tender-hearted people to systematic female infanticide, and then causing a huddling together of the endogamous polyandrous clans to keep themselves alive. It is no doubt true that the entrance of new conditions, such as a state of war or an advance in the arts, would have altered not only the relation of the sexes but also the moral laws of the people. Colonel Marshall's researches were especially suggested and guided by Mr. M'Lennan's "Primitive Marriage," and if a new edition is brought out of that important treatise (now out of print and scarce), the Todas will supply some items of valuable evidence to it, bearing on ancient social conditions of mankind.

Care must be taken, however, to interpret with proper reservation the word "primitive," as used in these inquiries. Colonel Marshall calls the Todas a "primitive tribe," and argues from their customs to the condition of "primitive races," nor is this objectionable if the word be meant only to signify a comparatively early stage of society. But the Todas are by no means primitive as representing the earliest known grades of civilisation: they are not savages, but a pastoral tribe in a condition much above savagery, belonging to the great Dravidian race of South India. Among them, moreover, may be noticed certain curious customs, to be accounted for on the principle of "survival in culture," and being apparently relics of a former condition of the race different from the present. The Todas are not now hunters, nor do they use bows and arrows. But, at a certain time after marriage, the Toda husband and wife go into the village wood, and kneeling before a lamp at the foot of a tree, the wife receives from the husband a bow and arrow made by him, which she salutes by lowering her forehead to them. Taking up the weapons, she asks, "What is the name of your bow?" each clan apparently having a different name for its bow; he tells her the name, and afterwards she deposits the bow and arrow at the foot of the tree. Colonel Marshall can hardly be wrong in his supposition that this custom has come down from a former period when the Todas actually carried such weapons. This is also confirmed by their funeral rites, where among the articles burnt for the dead man are a flute (an instrument they never use), and a toy bow and arrows, which they get made for the purpose by their neighbours the Kotas. When the author got a man to buy him one, the Kota who made it asked "Who is dead?" The inference is obvious, that the Todas were hunters before they took to their absolutely pastoral life. Nowadays, their cattle are all in all to them; not only their life but their religion turns on buffalo; the milkman is a divine personage too holy to be touched; the most sacred objects are certain ancient cow-bells, and the dignity of the sacred bell-cows is handed down from mother-cow to daughter-cow. The keeping up of this sacred heritage in the female line leads Col. Marshall to infer, at any rate ingeniously, that he has found here a relic of ancient days when the rule of kinship on the mother's side (which he considers with Mr. M'Lennan to characterise primitive society) still prevailed; it only now holds good of bulls and cows, while among men and women relationship is on the male side, thus following the rule which is considered to belong to a higher stage of society. It is not a new idea that the worship of the cow in Egypt and India had its origin not in myth but in practical expediency, being craftily devised to prevent the lives of such valuable creatures being wasted. But nowhere does this argument look so complete and rational as among those thoroughgoing devotees of the milk-can, the Todas.

It is to be feared that the title of Col. Marshall's volume may prevent its having all the popularity it deserves. Not that this title is misleading, for he accepts and uses confidently the now discredited phrenological system of bumps and organs, and tabulates his series of Toda skulls according to their Concentrativeness, Amativeness, Veneration, &c. On this classification by phrenological organs he founds a theory as to the relation between civilisation and the shape of the skull. It appears, from his description, that the Todas are a uniformly long-skulled race, though, among his dimensions, I fail to find anywhere the actual measurements of cranial length and breadth, and can only guess from the portraits (which, by the way, are beautiful autotypes), that the proportions of these two diameters may perhaps be something like 100 : 72 or 75 Now these dolichocephalic Todas being a kindly, harmless, indolent, unprogressive race, Col. Marshall proceeds to connect their narrowness of skull with their want of active energetic qualities, the phrenological organs of which are placed at the side of the head. Thus he comes to the conclusion that it is the brachycephalic tribes, with their skulls broadened by the fierce conquering and progressive organs, which come to the front in the march of civilisation. Well, no doubt there are various dolichocephalic tribes who have remained at low stages of culture, but how is it in the northern half of Asia, the abode of the broadest-headed tribes of man, whom nevertheless the comparatively long-headed Russians have for ages been beating with one hand and civilising with the other. Prof. Carl Vogt's treatment of the question is on a far broader basis, where in a few lines of one of his lectures he shows that both the extreme dolichocephalic and brachycephalic tribes are savages or barbarians, while the main work of civilisation has been done by people who are neither the one nor the other, the mesaticephalic or intermediate-headed races, such as ourselves. This is one of the points which make the reader regret that Col. Marshall did not keep his book waiting till he could bring his opinions under discussion at the Anthropological Institute or the Asiatic Society, which might have led him to modify his views in several ways. As it is, his preface is dated from Faizabad, and in it he describes himself as "a solitary Indian, far away from contact with men of science, but fresh from the actual and impressive presence of 'Nature's children.'" These words account for the freshness and vigour of his style, but they must not be taken to imply that his examination was made without want of knowledge of anthropology. So far from this, one of the great excellencies of the volume lies in showing how much more deeply an observer sees into the life of an uncivilised people, when he is engaged in examining evidence for and against current ethnological theories, than when he goes as a mere traveller, setting down at random anything that takes his attention.

EDWARD B. TYLOR

OUR BOOK SHELF

An Elementary Treatise on Geometrical Conic Sections. By G. Richardson, M.A. (Rivington, 1873.)

THIS is one of the volumes of the publisher's Mathematical Series, is very well printed, and has, if we are not mistaken, only three trivial misprints. There is quite a run at the present time on this subject, if we may judge by the number of treatises which have recently made their appearance, and this we are not altogether surprised at, as it is one of great interest; its theorems have great intrinsic beauty and almost boundless applications. The ordinary propositions are discussed not altogether in the usual order of consecution from the locus-point of view (the last chapter of four pages being devoted to the cone); the demonstrations are neat, and two or three are exceedingly concise as well. The only or chief novelty is the simultaneous treatment of the ellipse and the hyperbola, the corresponding propositions facing one another on the even and odd pages respectively. The discussion of the asymptotic properties of the latter curve pairs off against a series of propositions on projections. The book is a good working one for beginners, and embraces sufficient for the preliminary examination for mathematical honours at Cambridge, without having too much for school use. There is an extensive selection of exercises.

R. T.

Waste Products and Undeveloped Substances. A Synopsis of progress made in their economic utilisation during the last quarter of a century, at home and abroad. By P. L. Simmonds. (London: Hardwicke, 1873.)

MR. SIMMONDS'S book is seasonable in these days, when so much has been done in the utilisation of waste, as showing how very much yet remains to do.

In nearly 500 pages of close print he has drawn attention to a mass of matter almost bewildering in its vastness, and extending to nearly every kind of material in use in civilised communities. We cannot help noticing that Mr. Simmonds has been affected by the mass of subjects he has attempted, for the book very frequently displays a considerable lack of arrangement.

The author should look to this in a future edition, in which also the book might be easily and advantageously condensed to a considerable extent.

We must, however, thank the author for the service he does in calling the attention of civilisation to the extravagant, and we might say, "riotous" living with which its substance is wasted.

La Botanique de la Bible. Étude scientifique, historique, litteraire et exégétique des plantes mentionnées dans la Sainte-Ecriture. Par Frédéric Hamilton. 8vo. pp. 220, 25 photographs. (Nice: Eugène Fleurdelys, 1871.)

THIS interesting volume will possibly be unknown to the majority of our readers, and yet we venture to think that, from the beauty of its illustrations and the pleasantness of its style, it may to some of them prove a welcome addition to their knowledge of the subject on which it treats. Not stopping to discuss the nature of those mysterious trees said to have existed in the Garden of Eden, the author divides his subject into two parts. The first treating of the genera and species of which there can be little doubt, such as the pomegranate, almond, cedar, fig, &c.; and the second of those plants or portions of plants about which it is difficult to decide to what genus even they may belong, such as shittim-wood, hyssop, &c. In the first portion of the volume not only are the scientific characters of the plants given, but there is also added a series of references to them from the classics. The photographs are taken from living specimens growing chiefly in the neighbourhood of Nice and Mentone.

LETTERS TO THE EDITOR

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

Effects of Temperature on Reflex Action

I DO not know if I quite understand Mr. Lewes's objections to my little article in the *Journal of Anatomy and Physiology*. He attributes the absence of movements in the case in question to a loss of sensibility *to temperature*. At first his statement reads as if the loss of sensibility to temperature were due to the removal of the brain. But he cannot mean this, because the whole of my paper starts from the fact that when the toes alone are exposed to gradually heated water, the leg is withdrawn. If he means that the sensibility to temperature alone is destroyed or depressed by the exposure of the whole body to the gradually heated water, and the other "sensibilities" left intact, I do not see how my argument touching the difference between the entire and the brainless frog is affected at all by a limitation of the stimulus to one particular kind. Moreover, in the last observation recorded in my paper it is expressly stated that in the later stages of heating the absence or diminution of reaction towards chemical as well as thermal stimuli was observed. Gradually heated water acts as a very slight stimulus, sulphuric acid (even dilute) is a very strong stimulus; and that the latter suddenly applied, as in the experiment of Goltz referred to by Mr. Lewes, should call forth a reflex action at a time when the former is unable to do so, in no way contradicts my explanation of the absence of movements. A red-hot iron might have been substituted for the sulphuric acid with identical results.

The paper in question had for its object simply the solution of the difficulty why the brainless frog allowed himself to be boiled without moving. In it I carefully avoided entering upon any discussion concerning Sensation (or Consciousness) in the spinal cord. The words "movement of volition, *that is, a movement carried out by the encephalon*,"—"ordinary reflex action, that is, a movement *carried out by the spinal cord alone*," were purposely chosen. I went so far as to speak of an "intelligent frog" and an "unintelligent reflex action," because we have means of measuring intelligence, and we can speak of a body as being conscious and yet not intelligent. I imagine that if Mr. Lewes and myself were to talk over the matter quietly, he would find that I am not so much at variance with him as he imagines. I feel with him the difficulty of refusing to the protoplasm of a white blood corpuscle, a something which may be evolved into (not out of) consciousness. That and like difficulties are not a little increased if, as Mr. Darwin seems to suggest, we regard inherited voluntary acts as the chief instead of the occasional source of reflex actions. Without entering into any long discussion, perhaps I may be permitted to say that in such matters as the movements of a brainless frog, it seems to me there are two things which ought to be kept separate: the investigation into the laws according to which those movements take place, *i.e.*, the study of the various nervous mechanisms of the spinal cord, and the question whether those movements, whether the working of those mechanisms, is or is not accompanied by consciousness. As a physiologist I am prepared to busy myself with the first, as I see prospects of success. With regard to the second, I am not prepared to say anything until we have obtained some better tokens of consciousness than the greater or less resemblance of the movements in question to such movements as our conscious selves are in the habit of executing.

M. Foster

Meyer's Exploration of New Guinea

Few persons can have read Dr. Meyer's account of his recent adventurous and very successful journey with more interest than myself; but I confess I was surprised to find that the translator of my book should have misunderstood what I had stated, and so create a difference between us where none exists. He says (speaking of Dorey) that I "have 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.; and that he finds on the other hand, that "there is no generic difference at all between the Papooas of the mountain and the Papooas of the coast, except such differences as we find everywhere between the highlanders and coast inhabitants of the same race." Now I say exactly the same thing: "From these (sketches) and the captain's description, it appeared that the people of Arfak were similar to those of Dorey." ("Malay Archipelago," 3rd Ed. p. 505.) Dr. Meyer however, probably refers to what I say of the people of one hill village, close to Dorey: "The inhabitants seemed rather uglier than those at Dorey village. They are, no doubt, the true indigenes of this part of New Guinea, living in the interior, and subsisting by cultivation and hunting. The Dorey-men, on the other hand, are shore dwellers, fishers, and traders in a small way, and have thus the character of a colony who have migrated from another district. These hillmen, or Arfaks, differed much in physical features. They were generally black, but some were brown like Malays. Their hair, though always more or less frizzly, was sometimes short and matted," &c. (p. 499). I can only suppose that the word "differed" in the above passage was taken to mean "differed from the Dorey people," whereas the context shows that it means "differed among themselves," or varied, which would have been a better word. In the preceding page I have stated of the inhabitants of Dorey: "The majority have short woolly hair;" so that there is no difference from them in that respect. In all I have written about the Papuans I have maintained that the people of New Guinea and of all the immediately surrounding islands are of one race, with very unimportant local differences; and I do not think my remark, that the people of one village were "*rather* uglier" than those of another, three miles off, justifies the idea that I supposed there was any "difference," in an ethnological sense, between them. I cannot find that I have said a word about difference of stature.

The great success of both Messrs. D'Albertis and Meyer in penetrating inland in New Guinea will, it is to be hoped, induce other travellers to attempt the exploration of the far larger and less known southern portion. Two Europeans, with a small steam launch and a Malay crew, would, no doubt, be able to penetrate a long way up some of the larger rivers, and establish a station from which exploration of the central mountains might be effected. There is now no portion of the globe so completely unknown as this, or which promises such great results for every branch of Natural History.

Alfred R. Wallace

Deep-sea Sounding and Deep-sea Thermometers

With reference to the discussion which has recently been carried on in Nature as to the deep-sea thermometers, I hope that perhaps the following statement may tend to put the matter at rest.

One of Negretti's thermometers was exhibited at the Royal United Service Institution at a lecture, March 11, 1859, by Admiral FitzRoy, who then spoke of them "as thermometers peculiarly constructed, self-registering," &c. The construction of these thermometers had been fully described in the "First number of Meteorological Papers, 1857," and was subsequently given in a "Treatise on Meteorological Instruments," published by Negretti and Zambra in 1864. The peculiarity of these thermometers was mentioned in the Hydrographic Instructions to Captain Dayman of the *Cyclops* Sounding Expedition, dated May 29, 1857. These facts are sufficient to show the ample publication of the device in question for protecting the bulbs against pressure.

I know from Dr. Miller himself that he did not know of Negretti's plan. In his paper in the Royal Society Proceedings, he calls the one which he describes a "simple expedient." I am not aware of any just claim on the part of Mr. Casella to the principle of the invention.

I consider that the practice of instrument makers designating by their names instruments which they have not *invented*, is most reprehensible.

Robert H. Scott

London, Dec. 9

[We have received a letter on this subject also from Mr. Casella, but as there is nothing in it bearing on the real point at issue, we do not print it. The above letter from Mr. Scott renders it clear to us, and it will doubtless be also clear to our readers, that the whole credit of the double bulb belongs to Messrs. Negretti and Zambra. We quite agree also with Mr. Scott's closing remarks. This correspondence must now cease. —Ed.]

The Dutch Photographs of the Eclipse of 1871

About a year ago Dr. Schellen kindly sent me two paper copies of the Java photograph, one of them was stated to be of the size of the original negative and the other was an enlargement of about ten and a half diameters, with a delicately soft outline and much detail in the corona. On comparing this with the Indian photographs I found that though the outline of the corona corresponded depression for depression with the two Indian series, yet there was great difference in the detail of the lower parts. The question therefore arose, Was such difference to be regarded as proof of enormous change in the corona in the course of about an hour, during the passage of the totality shadow from India to Java?

I had carefully compared and catalogued the details visible upon the original negatives of the two Indian series, and had found no structure in the one that could not be traced in the other, but the details of the new Java photograph were quite of a different character, lumpy, and in more definite masses. On mentioning this to Lord Lindsay he informed me that he had other copies of the Java negatives which he had received directly from Prof. Oudemans and which were almost structureless. Mr. Davis undertook a critical comparison of the two Java photographs, and pointed out that in spite of the striking dissimilarity of the paper prints, they were evidently both taken from the same original, for they each showed a faint scratch and three minute photographic flaws in the same relative positions. It was impossible to assert that the one was a good print and the other a very bad one, for in the photograph with the delicate corona the moon's limb was soft and hazy, while with the poor corona the limb was perfectly sharp and definite. We had only one course left, and that was to infer that the softening and details had been produced artificially. Having detected manipulation in the corona, we naturally suspected it in the moon's limb, and thus arose my remark at the meeting of the Astronomical Society, that the sharp edges of the irradiation under the prominences might have been artificially produced by stopping out the moon, or rather by stopping out the hazy irradiation which presents so marked a feature, especially under the prominences in the Indian photographs, as well as in those taken in 1870.

There is still a little mystery which requires clearing up about the hazy irradiation. No trace of it is to be found in the copies of the Shelbyville photograph taken by Mr. Whipple in 1869, nor (as we now learn) in the Java photographs, although the action of the light has been greater in these than in some of the Indian and 1870 negatives, which show it as a very marked feature. We know that under ordinary circumstances hazy irradiation is produced by reflection at the hinder surface of the glass on which the photograph is taken, and that its amount may be greatly reduced by backing the plate, during its exposure, with wet paper, so as to produce a film of water instead of a film of air immediately behind the plate, thus causing nearly all the light to be transmitted instead of reflected at its back surface. Yet the Baikul photographs (and I understand also the Cadiz photograph of 1870) were backed with wet paper, and still show the irradiation very markedly.

The cause of the ellipticity of the dark moon touched upon by Prof. Oudemans seems to me to involve some very interesting questions. It is remarkable that the ellipticity does not occur in all eclipse photographs. After making allowance for the moon's motion during 40 seconds in the enlargement from the Cadiz negative, I may say that I have not been able to detect any difference between the polar and equatorial diameters in *any* of the 1870 photographs.

In No. 2 of the glass copies from the Ottumwa photographs, 1869, the moon is also apparently quite circular; but in No. 4, where the bright depths of the chromosphere are just appearing, the polar diameter is distinctly the longest. I have been led to conclude that the ellipticity is caused by an unequal eating over or irradiation at the polar and equatorial portions of the limb, and that in this lies proof that at the sun's equatorial regions the brighter layers of the chromosphere extend to a greater height than near the poles. We know from other sources that the corona generally, and probably also its lower portions, were not so bright in 1870 as in 1869 and 1871; hence the eating over between the prominences has been comparatively slight, and no detectable difference has been caused between the polar and equatorial diameters. A. COWPER RANYARD

The British Museum

IT is strange that such a statement as that advanced by Mr. W. Stanley Jevons in NATURE, Nov. 13, has so long remained unchallenged, viz. "that the British Museum exists not so much for the momentary amusement of gaping crowds of country people, who do not understand a single object on which they gaze, as for the promotion of scientific discovery, and the advancement of literary and historical inquiry." No one will dispute the truth of these statements, but substitute the word "instruction" for "momentary amusement," and I very much doubt if his views would meet with public approval. I have always looked upon the British Museum as the National Museum, and *pre-eminently* the Museum of the people, and, as such, the arrangement and labelling of the specimens should be of the most simple and instructive nature: nor is such an object opposed to, but perfectly coincident with, the highest interests of science. No wonder the Museum is filled with "gaping crowds" when nothing is done to instruct them as to the nature of objects of which Mr. Stanley Jevons himself admits they are ignorant, nor to provide them with a suitable and educational guide-book, without which they are as sheep without a shepherd When the Trustees of this Museum can spare time, they may, perhaps, be able to direct attention to the fuller development of its scientific and educational functions; as regards the former, by the establishment of one exclusively British Department; and, as regards the latter, by carrying out the very obvious suggestions which I have advanced. The view that science, or rather scientific men, should have a monopoly of the benefits to be derived from this Institution is astoundingly selfish and narrow-minded. If such are the views of the Trustees, the British Museum had better be closed to the public. S. G. P.

Moraines

I HAVE recently been visiting some of those spots which, according to Prof. Ramsay and other geologists, are marked by moraines of the ancient glaciers of North Wales, and several of which are supposed to form the retaining walls of lakes or tarns: and a question has arisen in my mind to which neither my own consideration nor any of the few books here at my command has afforded any answer.

A glacier which has retreated from its terminal moraine, is always the source of a stream of water, and this stream always cuts through the terminal moraine, and makes in it a gap often wide, and always reaching down to the level of the original soil. A terminal moraine from which a glacier has retreated is the rim of a saucer with a cleft in it, extending to the bottom of the saucer. It consequently cannot and does not act as a retaining wall, and the water from the glacier does not form a lake, but flows out as a stream. No better illustration of this fact occurs to me than the Rhone glacier, with its long series of terminal moraines, all intersected and cut through to the ground by the infant Rhone. How then can a terminal moraine ever form a lake? But if a terminal moraine alone cannot form a lake, a terminal moraine with a stopper put into its hole might. But how is the stopper to get there? Why should *débris* or stones or any other stopper stay in the one place in the whole line where there is no resistance?

Where the basin of the lake is supposed to be constituted by a rock basin and a moraine on its rim, what I have said has, of course, no application to the rock basin, but seems to me to apply to show that the moraine cannot constitute any part of the retaining barrier.

And again, where the retaining barrier is supposed to be constituted by a marine terminal moraine, *i.e.* by a moraine deposited under the sea, the observations I have made seem not to apply.

My questions apply to ordinary terrestrial terminal moraines. They are so simple and go so to the root of the whole notion that such moraines can form lakes that I presume they have been answered long ago by geologists. Can any of your readers tell me where such answers are given or what they ought to be?

Bryn Gwyn, Penmaenmawr, Oct. 13 EDW. FRY

The Elevation of Mountains and the Internal Condition of the Earth

I HAVE just read in NATURE, vol. ix. p. 62, Captain Hutton's letter to the Rev. Osmond Fisher on the "Elevation of Mountains and Volcanic Theories." I was also indebted some time since to the courtesy of Captain Hutton for a copy of his lecture on the Formation of Mountains, delivered at Wellington, New Zealand, November, 1872. Without entering at present into a discussion upon the particular theory which finds favour with him, I may be permitted to call attention to the fact that Sir William Thomson's views as to the rigidity of the earth have been distinctly called in question in a former number of this journal, which has probably not reached Captain Hutton. I refer to my communication entitled "The Rigidity of the Earth," printed in NATURE, vol. vii. p. 288. Captain Hutton expresses his belief that the theory of internal rigidity has probably a weak point somewhere. I venture to think that its weak points are so many as to make it a theory too brittle to form a support to any geological superstructure.

Dublin, November 28. H. HENNESSY

METEOROLOGIC SECTIONS OF THE ATMOSPHERE

THE primary object of meteorology is to record the pressure, the temperature, the moisture, the electricity, and the movements of the atmosphere. It is desirable, however, that observations on these subjects should be combined with the elements of time and distance. At the general meeting of the Scottish Meteorological Society on June 26, 1867, I proposed the method, since generally adopted, of reducing the intensity of storms to a numerical value by the calculation of barometric-gradients, or in other words by dividing the difference of reading of any two barometers by the distances between the stations where such barometers are placed, thus introducing a nomenclature of universal application, by which the movements of any aërial current, and particularly the wind force of storms, may in every part of the world be reduced to one standard of comparison; and the calculation of thermometric, hygrometric, and electric gradients was subsequently proposed. Since then I suggested to the same society the extension of this system by the establishment of a series of barometers placed at short distances from each other in one or more than one direction in azimuth, so as to give horizontal atmospheric sections for pressure. By means of such lines of section the maximum gradient during storms might, from the nearness of the stations to each other, be ascertained, and thus the phenomena of local storms and other local atmospheric disturbances investigated with some hope of success; and since then a horizontal section extending landwards from the sea-shore has been proposed for temperature and moisture, chiefly with the view of determining the extension inland of the influence of the sea on climate.

It would be important were the system of meteorological sections extended to the vertical as well as the horizontal plane. If a string of stations were placed at short horizontal distances from each other and extending from the bottom to the top of a high hill or mountain, the section thus obtained would show the relative distribution at different times, of pressure, temperature, humidity, &c., in the vertical plane. In Scotland, the existing station of Drumlanrig is 191 feet, and that at Wanlockhead 1,334 feet above the sea, so that the difference in elevation is 1,143 feet. The horizontal distance between them is 9 miles, and in all probability the necessary number of intermediate stations could be established. In Hong Kong the town of Victoria is 1,666 feet below that of Blockhouse Victoria Peak, while in Switzerland

and other mountainous districts many other suitable places might no doubt be found.

Would it not be possible to secure funds for establishing at least one such atmospheric section on the slope of some steep hill or mountain in connection with a station or two on an adjoining level district of country?

THOMAS STEVENSON

ON THE PHYSIOLOGICAL ACTION OF OZONE

At a meeting of the Royal Society of Edinburgh on the 1st inst., a communication was read from Mr. Dewar and Dr. M'Kendrick on the physiological action of ozone. The authors, in the first place, pointed out that little was known regarding the action of this substance, except its peculiar smell and the irritating effect it had on the mucous membrane of the respiratory tract. Schönbein had shown that a mouse died in five minutes in an atmosphere highly charged with ozone; and it was this distinguished investigator who asserted that there was a relation between the quantity of ozone in the air and the prevalence of epidemic diseases. The action of ozone was therefore a subject to be elucidated; and having occasion to employ ozone in another experimental inquiry, the authors resolved to investigate the matter. The ozone was made by passing a current of dry air or oxygen from a gasometer through a narrow glass tube, bent for convenience like the letter U, about 3 ft. in length, and containing a platinum wire 2 ft. in length, which had been inserted into the interior of the tube, and one end of which communicated with the outside through the wall of the tube. Round the whole external surface of this U-shaped tube, a spiral of copper wire was coiled, and the induction current from a coil giving half-inch sparks was passed between the external copper to the internal platinum wire, so as to have the platinum wire as the negative pole in the interior of the tube. After the stream of gas was ozonised by the transmission of the induction current, it was washed by passing through a bulb-tube containing caustic potash, when air was employed, or water when pure oxygen was used, in order to eliminate any traces of nitrous and nitric acids that might have been formed. By means of the gasometer, the volume of gas passing through the tube could be ascertained.

The action of ozone was determined (1) on the living animal enclosed in an atmosphere of ozonised air or of ozonised oxygen; and (2) on many of the individual living tissues of the body. Numerous experiments were made on frogs, birds, mice, white rats, rabbits, and on the authors themselves. Two experiments may be given here as illustrating the action of ozone on (1) a cold, and on (2) a warm-blooded animal.

1. *On a Frog.*—A large, healthy male frog was introduced into the air chamber, through which a current of air was passing sufficient to fill a litre jar in three minutes. At the end of two minutes, the respirations were ninety-six per minute. The induction machine was then set to work so as to ozonise the air. In half a minute, the eyeballs were retracted, so as to appear deeply sunk in the orbits, and the eyelids were closed; the respirations were now eight per minute. At the end of six minutes, the animal was motionless, and there were no respiratory movements. Pure air was then introduced. In half a minute, there was a slight respiratory movement, and in eight minutes there were eighty five respirations per minute. At the end of other twelve minutes, ozone was again turned on, with the same result. A frog will survive in a dormant condition in an atmosphere of ozonised air for several hours In one case, the animal died. The heart was found still pulsating. It was full of dark blood. The lungs were slightly congested. The blood was venous throughout the whole body. In ozonised oxygen the effects were, on the whole, the same as in ozonised air, with this difference, that in ozonised oxygen the respiratory movements were not affected so quickly, and were never completely arrested.

2. *On a White Mouse.*—A full grown and apparently healthy white mouse was introduced into a vessel through which a stream of air was passing at the rate of eight cubic inches per minute. Five minutes thereafter, the animal was evidently at ease, and the respirations were over 100 per minute. The air was then ozonised. One minute after, the respirations were slower, but the number could not be ascertained owing to the animal moving uneasily about. In four minutes from the time of the introduction of the ozone, the respirations were thirty-two in a minute. The mouse now rested quietly, occasionally yawned, and, when touched by a wire, moved,—but always so as to remove its nose from the stream of ozonised air. At the end of fifteen minutes, the animal had slight convulsive attacks, which increased in severity until it died—nineteen minutes after the introduction of the ozone. The post-mortem appearances were great venous congestion in all parts of the body. The heart pulsated for several minutes after systemic death. In ozonised oxygen, death was delayed for a much longer period. Instead of dying at the end of fifteen or twenty minutes, as happened to mice in ozonised air, they lived for forty or sixty minutes. It is noteworthy that even after death in ozonised oxygen, the blood was found to be in a venous condition.

On breathing an atmosphere of ozonised air themselves, the authors experienced the following effects:—a suffocating feeling in the chest; a tendency to breathe slowly; irritation of the fauces and glottis; a tingling of the skin of the face and conjunctivæ. The pulse became feebler. The inhalation was continued for eight minutes, when they were obliged to desist; and the experiment was followed by violent irritating cough and sneezing, and for five or six hours thereafter by a sensation of rawness in the throat and air-passages.

The general result of the inquiry may be briefly stated as follows:—

1. The inhalation of an atmosphere highly charged with ozone diminishes the number of respirations per minute.
2. The cardiac pulsations are reduced in strength and this organ is found beating feebly after systemic death.
3. The blood is found after death to be in a venous condition, both in those cases of death in an atmosphere of ozonised air and of ozonised oxygen.
4. The inhalation of an ozonised atmosphere is followed by a lowering of the temperature of the body to the extent of at least 3° to 5° C.
5. The inhalation of ozone does not exercise any appreciable action on the capillary circulation, as seen in the web of the frog's foot under the microscope (200 diameters).
6. In the bodies of frogs killed in an ozonised atmosphere, the reflex activity of the spinal cord is not appreciably affected.
7. By means of a myographion, the work done (in gramme-millimetres) by the gastronemius muscles of frogs subject to the action of ozone was noted. The muscles were stimulated by a single opening or closing induction shock produced by Du-Bois-Reymond's apparatus and a Daniell's cell. The result was that the contractility and work-power of the muscle were found to be unaffected.
8. Ozone has an action on the coloured and colourless corpuscles of human blood and of frog's blood resembling that produced by a weak acid; and in the case of the coloured corpuscles of the frog like that of a stream of carbonic acid. The corpuscles of animals killed in an ozonised atmosphere are normal in appearance.
9. Ciliary action is not affected by a stream of ozonised air or oxygen, provided there is a considerable amount of

fluid covering the cilia; but if the layer of fluid be very thin, the cilia are readily destroyed.

In conclusion, the authors stated that it would be premature, at this stage of the inquiry (which opened up many points of interest in the physiology of respiration), to generalise between physiological action and the physical and chemical properties of ozone; but they pointed out the fact that the density of ozone ($O_3 = 24$) is slightly greater than than that of carbonic acid ($CO_2 = 22$); and that although the chemical activity of the substance is much increased, yet, when inhaled into the lungs, it must retard greatly the rate of diffusion of carbonic acid from the blood, which accounts (from the accumulation of CO_2) for the venous character of that fluid after death. From this point of view, destruction of life by ozone (with the exception of its irritant action) resembles that caused by an atmosphere surcharged with carbonic acid. This has been found to be the case more especially as regards the diminished number of respirations per minute, and the appearance of the blood after death. If, however, the analogy were perfect, the inhalation of an atmosphere of ozonised oxygen would not have produced death, because it is now well known, as shown by Regnault and Reiset,* that animals can live in an atmosphere containing a large per-centage of carbonic acid, provided there is an excess of oxygen present. The amount of oxygen in these experiments converted into ozone certainly never exceeded ten per cent. But the authors have observed that an animal lives only a somewhat longer time in ozonised oxygen than in ozonised air; and they are thus induced to regard ozone as having some specific action on the blood that their future experiments may elucidate. They are now prosecuting a series of researches (*a*) on the action of smaller percentages of ozone; (*b*) on the action of ozone on noxious gases and effluvia; and (*c*) on any therapeutical or hygienic influences it may have on the origin and treatment of zymotic diseases.

THE ATMOSPHERIC TELEGRAPH †

II.

A VERY common question with visitors who witness the departure of a train is,—If the boxes stick on the road how do you manage to disengage them? To answer this question we shall notice in detail the various

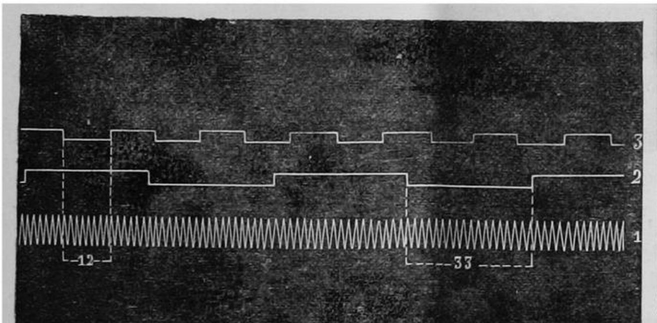

FIG. 3.—Diagram of the Chronograph. 1. Line of the electric *trembleur*. 2. Line of the seconds' pendulum. 3. Line of the membrane.

means employed in transmission, and thus we shall classify the derangements.

Let us commence with the tubes. These may cause an obstruction by a defect of the interior polish, by projecting joints, or by the escape of air through these joints. In the Paris system, however, precautions have been taken against these three sorts of danger. The degree of polish is sufficiently perfect, being obtained without hammering, by pushing the tube along a mandril before it becomes completely cooled. The joints represented in Fig. 2 (p. 66), give an almost mathematical continuity to the interior surface, and they are rendered air-tight by means of India-rubber fittings. In this direction, then, there is little risk of damage and the consequent stoppage of the trains. In fact, since 1866 there has not been a single accident caused by any defect in the tubes, and the experiment is made upon a length of twenty kilometres of pipes so constructed that joints occur every five metres.

The derangements arising from the machinery for compressing the air are not of a special character, and need not be particularised here. There remain the boxes. Numerous types were tried before the system of the two cases in tin and leather, which can be hermetically closed and are easily opened; from its simplicity this method has been adopted. Nevertheless it does sometimes happen that the boxes open during the journey; how this is caused is not easy to explain in each particular case. Sometimes the collarette of the piston is in a bad condition, and the air divides the train; the cases are separated, and the despatches are scattered in the tube. At other times wrinkles are formed in the envelope of leather, the effect of which is to wedge the train so firmly that it is impossible to make it move. Another form of derangement is when the piston breaks and the pieces are lodged between the boxes and the tube. It is scarcely possible to exhaust the series of accidents of this nature; the mean number of derangements in the working of the system during the year is eight, and it is rare to find the same cause occurring twice. When accidents do occur, it is necessary to make all haste to relieve the train.

Often alternate manœuvres with compressed and rarified air removes the obstruction; at Berlin, for the same purpose, M. Siemens employs water with which he forcibly inundates the tube. The great thing is to extricate the train without having to take the line to pieces. When such means fail it is necessary to have recourse to the operation of excavation; and the necessity will be evident of a preliminary and sufficiently exact determination of the place of derangement. The first means is indicated by the method on which the system is worked. There is at hand a reservoir of compressed air of a certain pressure; if this air is partly distributed in the section of the tube comprised between the reservoir and the obstacle, the new pressure is in a known ratio to the original pressure. In a word, Mariotte's law, which regulates the ratios of the pressures and volumes of the same mass of gas in two different circumstances, furnishes the means of finding *one* of the elements, volume, when we know the three others, two pressures and one volume.

M. Siemens prefers to measure the quantity of water which it is necessary to distribute in order to flood the line as far as the obstacle; the accuracy ought to be very great, but it must be acknowledged that the process, in spite of its apparent simplicity, has a somewhat primitive aspect. It is not difficult to understand how this great mass of water is introduced, but it is very difficult to conceive that it can easily remove the obstacle.

We may speak, finally, of an indirect means which is illustrated in Fig. 4. The reader knows that when a concussion is produced at the end of a tube filled with air, this concussion is propagated in the air of the tube at a speed of 330 metres per second. When the concussion encounters an obstacle, it is reflected and returns to the point of its origin at the same rate of 330 metres per second. If then the time is noted which elapses between the departure and the return, the period thus obtained corresponds to the passage of the concussion along a distance equal to double the distance of the obstacle; from an observation of the time, the distance can be easily calculated

* "Air and Rain," by Dr. Angus Smith, p. 182. (London, 1872.)
† Continued from p. 66.

For example:—The interval of time between the departure and return of the wave produced by the concussion is $\frac{1}{3}$ of a second; the double journey is represented by $\frac{330 \text{ m.}}{3} = 110$ m., and the distance of the obstacle is $\frac{110}{2} = 55$ metres.

The times of the departure and of the return of the wave are graphically registered on a chronograph, by the interruption of an electric circuit obtained by the motion of a membrane of caoutchouc placed at the extremity of the tube.

It is known that an electric current magnetises a horseshoe magnet. The magnetisation of the magnet communicates to a palette placed above the poles, an attraction which ceases as soon as the current is broken. Without entering into further explanation of this well-known arrangement, which is the basis of nearly all telegraphic apparatus, it will be granted that with conveniently placed conductors it will be possible to make the armature of the magnet move like the elastic membrane; in other words, if the membrane is raised 2, 3, 4 times in a second, the armature will be connected 2, 3, 4 times, and the durations as well as the intervals of the contacts will be identical in the two apparatus.

Let us return to the chronograph. The time is marked by it, and is recorded by means of electro-magnets. The oscillations of a seconds pendulum are repeated electrically and registered on a line, No. 2 in Fig. 4, which is described by a point fixed to the electro-magnet, upon a smoke-blackened cylinder, to which is given a movement of continuous rotation. The electro-magnet whose point describes line No. 2, is moveable on a carriage that advances along the cylinder in the same time as the latter takes to turn. The carriage bears two other electro-magnets: one corresponds to a sub-divisor of the time which gives fractions less than a second. It is this which

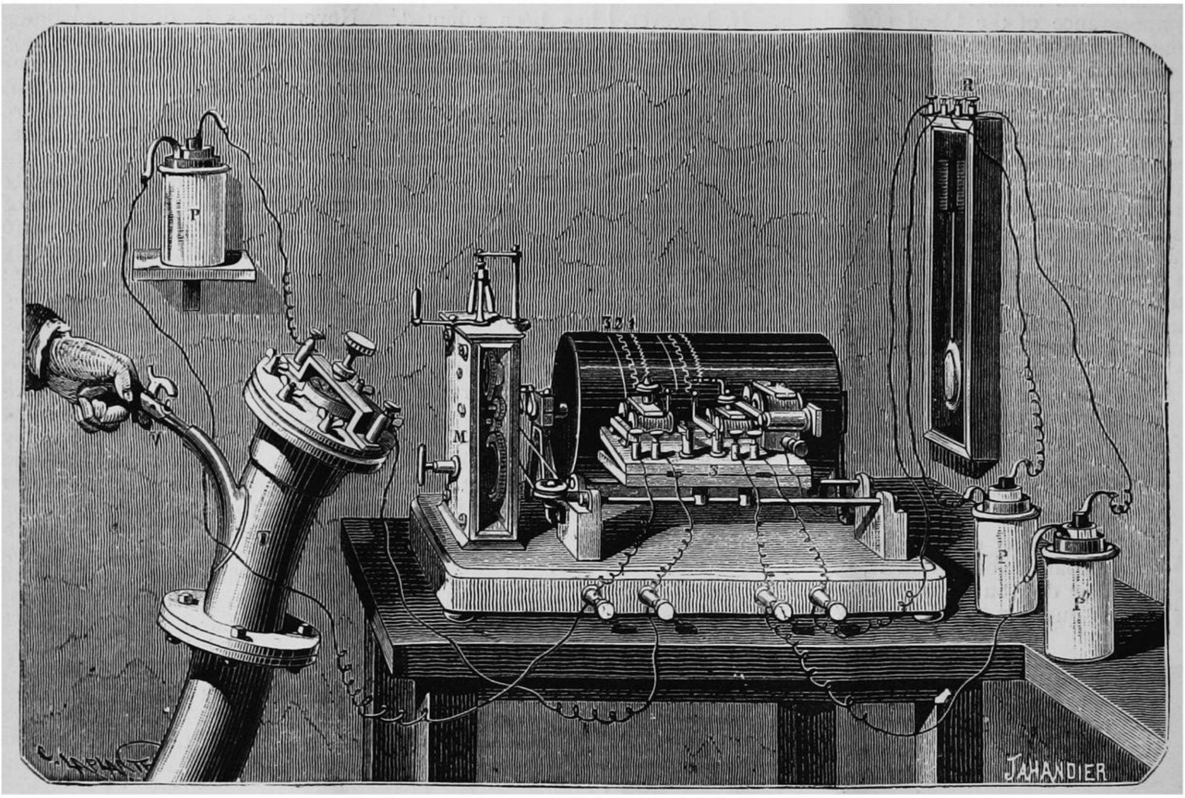

FIG. 4.—Chronograph for determining the point of stoppage of a train.

traces line No. 1, representing by its tracings sub-divisions equal to $\frac{1}{33}$rd of a second; this division into fractions corresponds to the oscillations of the palette of an electric *trembleur*, a contrivance in which the interruptions and re-establishment of the current take place at the rate of 33 per second in the model here represented.

The third electro-magnet, in connection with the membrane of caoutchouc, corresponds to the movement of the wave in the tube; it furnishes line No. 3 in the figure. It may be remarked that the same wave undergoes many successive reflexions.

It will be easily seen from the diagram how the result sought can be obtained from the experiment. Suppose the obstacle to be placed at 62 metres; the interval between two successive marks of the membrane is about 12 sub-divisions. A comparison of lines 1 and 2 shows that there are 33 sub-divisions in *one* second; the indications of line 3 then are equal to $\frac{12}{33}$ of a second. The double distance represents $\frac{12}{33} \times 330$ m, and the simple length given by the experiment is thus about $\frac{1}{2} \times \frac{12}{33} \times 330 = 60$ metres, the result sought to within 2 metres.

Fig. 4 shows the method adopted for producing the wave. On the left T is the tube in which a small pistol V is placed to produce the detonation which gives rise to the wave. On the table in the centre of the figure is the chronograph; M is the clock-work which turns the registering cylinder, on the surface of which are traced the lines 1, 2, 3; S is the carriage bearing the three electro-magnets, each of which traces its line. The electro-magnet on the right, line 1, is the *trembleur*, in connection with the pile P P″. The middle electro-magnet, line 2, is connected with the seconds pendulum R. Finally, the electro-magnet on the left, line 3, communicates electrically with the caoutchouc membrane that surmounts the tube T, and exactly fits the opening, on which it is stretched like a drum-skin.

THE COMMON FROG*

VI.

The Skeleton of the Frog

IT may cause surprise to speak of the skin of the common Frog as part of its skeleton, consisting as the skin does of soft membranous structures only.

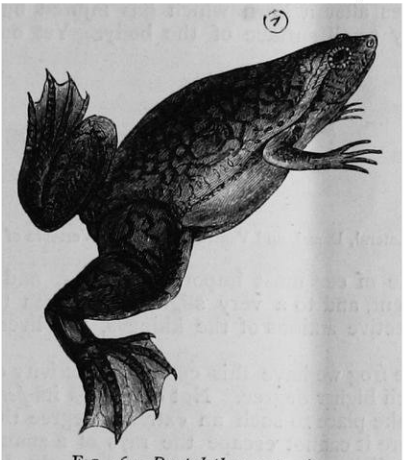

FIG. 26.—*Dactylethra capensis.*

The term "skeleton," however, should properly include all the membranous and gristly, as well as the bony structures.† Moreover, more or less of the skin may attain to so solid a condition as fully to justify its comprehension under the name "skeleton," even in the popular signification of that term.

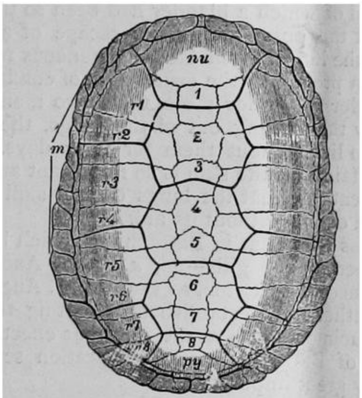

FIG. 27.—Dorsal surface of the Carapace of a Fresh-water Tortoise (Emys) 1—8, expanded neutral spines; r^1—r^8, expanded ribs; *nu*, first median (or nuchal) plate; *py*, last median (or pygal) plate; *m*, marginal scutes. The dark lines indicate the limits of the plates of the horny epidermal tortoise-shell; the thin sutures indicate the lines at the junction of the bony scutes.

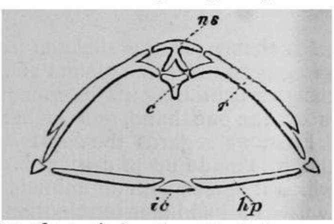

FIG. 28.—Diagram of a vertical section of both Carapace and Plastron of a Tortoise, made transversely to the long axis of the skeleton *c*, vertebral centrum; *ns*, neural spine which expands above into a median dorsal scute; *r*, rib which forms one mass with a lateral scute and terminates at a marginal plate; *ic*, inter-clavicular scute; *hy*, hyo-sternal scute.

* Continued from p. 69.
† See "Lessons in Elementary Anatomy," Lesson II., p. 22.

The skin of Vertebrate animals consists of two layers: an outer layer (the epidermis or *ecteron*), and an inner layer (the dermis or *enderon*). The *epidermis*, and any projections or processes developed from it when they take on a dense or hardened structure, become *horny*. Of such horny nature are hairs, feathers, nails, and scales, they are more or less dense *epidermal* appendages. The *dermis* when hardened becomes *bony*, and of such nature are the bony skin-plates or "scutes," and teeth. They are *dermal* appendages. Now both layers of the skin of the common Frog are entirely soft and utterly destitute of any of these appendages. Allied forms, however, present us with examples of some interesting epidermal conditions. Thus in old male Toads, in *Dactylethra* and in one of the Japanese efts, the epidermis of some of the finger-tips becomes hardened and horny, in other words we begin to meet with incipient "nails." "Incipient" because, in ascending from the lowest vertebrates, "nails" are first

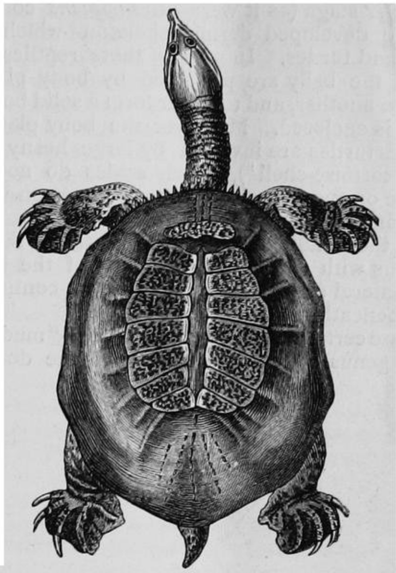

FIG. 29.—A Mud-tortoise (*Trionyx*), showing the dorsal plates.

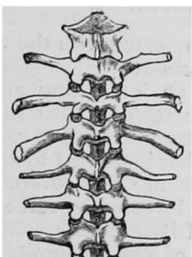

FIG. 30.

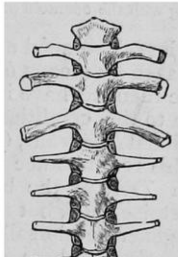

FIG. 31.

FIG. 30.—Backbone of the Frog (dorsal aspect). FIG. 31.—Backbone of the Frog (ventral aspect).

met with in the Frog's class, and these only very rarely and in an imperfectly developed condition.

As has been mentioned, in two kinds of Frog (*Ceratophrys* and *Ephippifer*) the skin of the back is furnished with bony plates. These are found in the deeper layer or dermis, and are therefore "scutes."

The remarkable circumstance, however, is that we have here a lower stage (as it were an *incipient* condition) of that more developed dermal skeleton which exists in tortoises and turtles. In most of these reptiles both the back and the belly are protected by bony plates which adjoin one another, and together form a solid box in which the body is enclosed. Moreover the bony plates of tortoises and turtles are invested by large horny epidermal scales ("tortoise-shell"), which scales do not agree in either size or number with the bony plates on which they are superimposed.

Again, the middle series of bony plates of the back are continuous with the subjacent joints of the backbones, and the lateral series of dorsal plates are continuous with the ribs beneath them.

There are certain Chelonians, however—"mud-tortoises"—(of the genus *Trionyx*), which have the dorsal plates

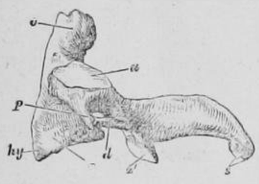

Fig. 32.

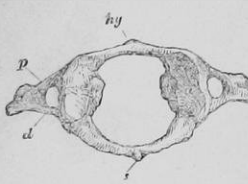

Fig. 33.

Fig. 32.—The Axis Vertebra. *c*, centrum ; *s*, neural spine ; *d*, tubercular process ; *p*, capitular process ; *a*, anterior articular surface for atlas ; *z'*, postzygapophysis ; *o*, odontoid process ; *hy*, median vertical ridge beneath centrum. Fig. 33.—The Atlas Vertebra. *s*, rudiment of neural spine ; *d*, tubercular process ; *p*, capitular process ; *a*, articular surface for skull ; *hy*, plate of bone holding the place of a cranium, and articulating with the odontoid process of the axis vertebra.

much less developed and not connected with the ventral plates save by means of soft structures.

Here then we have in reptiles an interesting approximation to the condition we have seen to exist in those exceptional Anourans, *Ceratophrys* and *Ephippifer*. Moreover this resemblance is still further increased by the fact that in *Trionyx* the bony plates are not covered with any tortoise-shell, but are merely invested by soft skin as in the genera of dorsally-shielded Batrachians.

Have we then here a true sign of genetic affinity? Are these tortoises to be deemed the more specially modified descendants of shielded frogs or of some as yet unknown slightly-shielded animals which were the common ancestors both of frogs and tortoises?

Certainly tortoises cannot be the direct descendants of frogs, they agree with all reptiles in characters which are both too numerous and too important to allow such an opinion to be entertained for a moment.

The other opinion is hardly less untenable ; for if all the multitudinous species of frogs (together with a number of reptilian forms more closely allied to the tortoise than any frogs are) descended from slightly shielded animals, how comes it that all frogs and toads, save one or two species in no other way peculiar, have every one of them lost every trace of such shielded structure which nevertheless cannot easily be conceived to have been in any way *prejudicial* to their existence and survival?

On the other hand, it cannot but strike us with surprise that structures so similar—extending even to the continuity of the dorsal plates with the subjacent joints of the backbone—should have arisen twice in nature spontaneously. Here we seem to have a remarkable example of the independent origin of closely similar structures ; and if so, what caution is not necessary before concluding that *any* given similarity of structure are undoubted marks of genetic affinity!

The skin of the frog is also interesting from a physiological point of view. Our own skin is by no means popularly credited with the great importance really due to it. "Only the skin!" is an exclamation not unfrequently heard, and wonder is very often felt when death supervenes after a burn which has injured but a comparatively small surface of the body. Yet our skin is

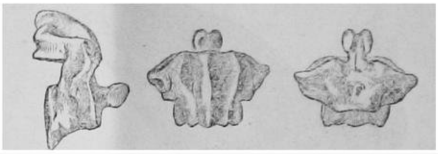

Fig. 34.—Lateral, Dorsal, and Ventral view of first Vertebra of *Amphiuma*.

really one of our most important organs, and is able to supplement, and to a very slight extent even to replace, the respective actions of the kidneys, the liver, and the lungs. *

In the frog we have this cutaneous activity developed in a much higher degree. Not only does its *perspiratory* action take place to such an extreme degree that a frog tied where it cannot escape the rays of a summer's sun speedily dies—nay, more, is soon perfectly dried up—but its *respiratory* action is both constant and important. This has been experimentally demonstrated by the detection of the carbonic acid given out in water by a frog over the head of which a bladder had been so tightly tied as to prevent the possibility of the escape of any exhalation from the lungs. The fact of cutaneous respiration has also been proved by the experiment of confining frogs in cages under water for more than two months and a half, and by the cutting out of the lungs, the creature continuing to live without them for forty days. Indeed it is now certain that the skin is so important an agent in the frog's breathing that the lungs do not suffice for the maintenance of life without its aid.

It is no less true that in Batrachians which breathe by means of permanent gills—as, *e.g.* the Axolotl—such gills are not necessary to life, as the late M. Aug. Duméril and Dr. Günther have established by cutting them away without inducing any apparent injurious effects. In the whole class of Batrachians skin respiration seems, then, to be of very great importance.

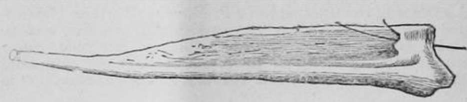

Fig. 35.

Fig. 36.

Fig. 35.—Coccyx of Frog, lateral view, a black line indicates the course of the sciatic nerve. Fig. 36.—Anterior aspect of Coccyx, showing the double articular concavities placed side by side beneath the neural arch.

The *internal* skeleton (or the skeleton commonly so called) of the frog presents some points of considerable interest, especially as exhibiting its intermediate position between fishes on the one hand, and higher vertebrates on the other. First, as regards the *backbone*, it may be remembered that it is made up of distinct bony joints (or *vertebræ*), in which it agrees with all animals above fishes and with bony fishes ; its hinder termination, however, is essentially fish-like. It is fish-like, because the terminal piece, as it is called, or "*coccyx*" (unlike the coccyx in man or in birds) is not formed of rudimentary vertebræ which subsequently blend and anchylose together, but is formed by the ossification continuously of the membrane investing (or *sheath* of) the hindermost part of that primitive continuous rod, or notochord, which, as has been said,

* See "Elementary Physiology," Lesson V., § 19.
† From Νῶτος, back, and Χορδη, chord.

precedes, in all vertebrate animals, the development of the backbone, making its appearance beneath the primitive groove.

The vertebræ are shaped like rings, and enclose within their circuit the spinal marrow upon which, as it were, these rings are strung. From the side of each ring (except at the two ends of the backbone) there juts out a bony prominence called a "transverse process," and to a certain number of these a bony "rib" is in most vertebrate animals attached (though there are none in the frog), often extending round to join the breast-bone in front, and being capable of more or less motion, so as (by their simultaneous movement) to be able to enlarge or to contract the cavity of the chest, which they thus enclose and protect.

That part of each vertebra which is placed next the body cavity is generally the thickest part, and is called the "body," or "centrum." The series of bodies (or centra) occupy the position which was at first filled by the primitive notochord, the rest of the vertebral rings having been formed in the sides and roof of the canal formed by the upgrowth and union of the two sides of the primitive groove of the embryo.

The frog order is distinguished amongst vetebrates as that which has the absolutely smallest number of joints in the backbone. In the frog there are but nine in the front of the coccyx. In the Pipa toad there are but seven, the eighth vertebra (to the transverse processes of which the haunch bones are attached) having become solidly joined in one bone with the coccyx.

In all higher vertebrates, *i.e.* in all beasts, birds, and reptiles, the head is supported on an especially ring-like vertebra which—because it so supports—is called the *atlas*, and this (in almost all) can turn upon a peculiar vertebra termed (from this circumstance) the *axis*, and provided with a toothlike (*odontoid*)* process, round which, as round a pivot, the "atlas" works. Nothing of the kind exists in any fish.

In the frog (and in all its class) we find but a single vertebra representing these two, but in some allied forms, *e.g.* in *Amphiuma*, this vertebra develops a median process, reminding us of the odontoid process of the axis.

The frog, as has been said, has no ribs, in spite of the long "transverse processes" which project out on each side of the backbone. Ribs are not necessary to it, for it could apply them to none of the purposes to which ribs are ever applied.

In all beasts ribs aid importantly in respiration, serving by their motions alternately to inflate or empty the lungs by enlarging or contracting the cavity of the chest in the way before mentioned. The frog, however, breathes exclusively, as regards the lungs, by *swallowing* air by a mechanism which will be described shortly.

In serpents the ribs are the organs of locomotion, as also in the Flying Dragon before referred to; but in frogs locomotion is effected exclusively by the limbs. In the very aberrant species, *Pipa* and *Dactylethra* there are on each side of the anterior parts of the body two enormously long transverse processes, each process bearing at its extremity a short flattened, straight osseous or cartilaginous rib. These little ribs can, however, take no part in such functions as those just referred to.

Ribs, moreover, are found in the other existing orders of the frog's class, *i.e.* both in the *Urodela* and *Ophiomorpha*. In none, however, do they join a breast-bone, or sternum, another character in which *Batrachians* agree with fishes, though they differ from fishes in that they have a sternum at all. In ascending from fishes through the vertebrate sub-kingdom, a sternum first appears in the class *Bratrachia*.

In a certain North African Salamander named *Pleurodeles* the ribs are not only elongated, but their apices, if they do not actually perforate the skin, are so prominent as to seem to do so when the finger is drawn from behind forwards along the side of the animal's body.

The several joints of the backbone are connected together by surfaces which are not the same on both the anterior and posterior sides of the centrum, or body, of the same vertebra. Each of the first seven vertebræ is furnished with a round prominence, or head, on the hinder side of its centrum, and each of the precoccygeal vertebræ, except the first and last, has the anterior surface of its centrum excavated as a cup for the reception of the ball of the hinder surface of the vertebra next in front. The first vertebra has in front two concavities, side by side, to articulate with the skull. The eighth vertebra has a concavity at each end of its "body." The ninth vertebra has a body provided with a single convexity in front and a double convexity behind, to articulate with the concavities placed side by side on the front end of the coccyx.

These arrangements are not constant in the frog's order, still less in its class. In *Bombinater* and *Pipa* the vertebræ are concave behind each centrum, instead of in front: and the same is the case in *Salamandra*. In many tailed Batrachians the vertebræ are biconcave, as *e.g.* in *Spelerpes*, *Amphiuma*, *Proteus* and *Siren*.

The biconcave shape is an approximation towards the condition which is almost universal in bony fishes, though not quite universal, since the bony pike (*Lepidosteus*) has a ball at one end of each vertebra and a cup at the other. Moreover, even in some reptiles (*e.g.* the lizards called *Geckoes*) the vertebræ are biconcave, and the same was the case with the majority of those species of crocodiles the remains of which are found in strata older than the chalk, and even in existing crocodiles the first vertebra of the tail is biconcave.

Vertebræ with a cavity in front of the centrum and a ball behind it are found in the crocodiles now living as well as in the frog, while vertebræ with a ball in front and a concavity behind are found even amongst beasts, as in the joints of the neck of Ruminants, *e.g.* the sheep. Thus though the vertebræ of the frog's class exhibit no very decided signs of affinity, they show more resemblance to those of fishes than to those of any other non-batrachian class.

The transverse processes of the ninth or last vertebra in front of the coccyx, articulate with the haunch bones, but are not very remarkable in shape. In some frogs and toads the transverse processes of this vertebra become enormously expanded, and the expanded or non-expanded condition of this part is a character made use of in zoological classification. The coccyx is made up mainly, as has been said, of a continuous ossification of the sheath of the notochord, and never consists of distinct vertebra. Nevertheless, the small bony arches which are at first distinct coalesce with it. These arches are called "neural" because they arch over the hinder part of the spinal marrow. The great nerve of the leg (the sciatic nerve) proceeds outwards on each side through a foramen situated at the anterior end of the coccyx from the spinal marrow—the spinal marrow being that structure which gives origin to the great mass of the nerves pervading the entire frame.

ST. GEORGE MIVART

(*To be continued.*)

[The author sincerely regrets, that by an inadvertence for which he is exclusively answerable, two cuts introduced into the second of these articles, namely, the figures representing *Rina esculenta* and *Bufo vulgaris*, were copied, without sanction, from two illustrations in Professor Bell's "History of British Reptiles," published by Mr. Van Voorst, to whom, therefore, this apology is due.]

* From ὀδούς, a tooth, and εἶδος, form.

EARTH-SCULPTURE *

III.

I DO not consider it necessary to defend my facts. They are familiar enough to the geologists of this country, as displayed more or less plainly in every district of our island. I am at present concerned with the counter-statements which the Duke of Argyll would put in their place.

He states his belief that the Highland mountains have had their contour mainly given to them by "upheavals, subsidences, and lateral pressures, which have folded them and broken them into their present shapes." A belief of any kind must be founded on evidence of some sort, and that evidence must be produced if the owner of the belief desires that it should be accepted by others besides himself. What evidence, then, does his Grace furnish as the basis on which he expects that his "belief" is to supersede what he is pleased to term "the extravagant theories of the younger glacialists"? Having shown "the antecedent improbabilities involved in the extreme theories of erosion," he states that he "proceeds to test them on the field of fact." We follow him anxiously to the field in question, and find that his so-called facts are stated in such words as these: "Loch Fyne . . occupies, as I believe, the bed (*sic*) of an immense fault." "The transverse valley of Loch Eck lies across a steep anticlinal, and is due, in my opinion, to the extreme tension to which the crystalline rocks have been subjected." "The Pass of Awe is a rupture and chasm." These, and other similar assertions regarding various parts of the Highlands are confidently expressed, but they are accompanied by no evidence by which their accuracy may be tested. In truth, the "facts" which his Grace adduces in support of his "belief" are only other "beliefs" and "opinions" of his own. They may be correct or the reverse, but they cannot legitimately be adduced as evidence in a scientific argument. But they are very far from correct. I utterly deny, for example, the assertion that Loch Fyne lies along the bed of an immense fault, and I ask the Duke of Argyll to try to prove that it does so. Nay more, I challenge him to produce a geological section which would bear a moment's examination on the ground, in which he can show the coincidence of a valley with a line of fault in any part of his own county of Argyll. That cases of this coincidence may be found I do not doubt, but the search for them will be useful in teaching his Grace how exceptional they are.

The Duke of Argyll does indeed offer some explanatory statements regarding some of his assertions of fact. For instance, with regard to Loch Awe, he dwells on the inclinations of the slates and the intrusion of the porphyries among them as evidence that the present contour has been directly the result of subterranean convulsion, and he triumphantly adduces these and similar appearances "ignored" by myself as a demonstration of the truth of his "belief." But any one who knows the Highland rocks at all may well smile when he is told that a geologist who had ever been over the ground, even in the most cursory way, requires to have these phenomena pointed out to him. In reality I had already granted the existence of these, and far more wonderful evidences of underground movements, for I knew the Highland rocks well, and had mapped their structure over leagues of ground from the mountains of Sutherland to the moors of Forfar, and the headlands of Islay. I was therefore perfectly familiar with the phenomena to which the Duke of Argyll so confidently refers. But I had learned more about them than merely their tale of subterranean turmoil. I had found that they did not bear directly on the origin of hill and valley at all. I had traced everywhere evidence that what we now see of intruded granite or curved slate has been laid bare only after the removal of hundreds and thousands of feet of rock under which they once lay. His Grace, it would seem, has still this lesson to learn, and until he has mastered it, and, apart from any theory but simply as a matter of demonstrable fact, has realised what it involves and how vain is the attempt to connect the contorting and hardening of the rocks with the *present* surface features of the country, argument with him on this question seems hardly possible.

Again, I had quoted the mountain Ben Lawers, with its flanking hollow in Loch Tay, as a typical example of the kind of evidence which could be abundantly adduced from all parts of the Highlands to show the relation between geological structure and external form, and to prove from under what an enormous mass of removed rock the present surface of the Highlands has appeared. I gave a section to show at a glance the broad facts of the case—a section from which no conclusion is possible but that which I drew. But here, once more, the Duke of Argyll's belief in the all-powerful efficacy of granite and igneous rocks, or his thraldom to what he calls "the influence of a preconceived theory," brings out in well-marked prominence that obliquity of vision which prevents him from seeing anything but convulsion and fracture. He scents intrusive rocks of some sort along the south bank of Loch Tay. It would be vain to remonstrate that this alleged influence of the igneous rocks is, to say the least, as pure "invention and imagination" as anything which the "younger school" could readily supply, or that the denudation of that region is a momentous fact to be looked in the face and explained, not to be dismissed or denied, no matter what our "theory" or "belief" may be regarding the origin of granite. Without further ceremony, the proofs of enormous denudation at Ben Lawers and Loch Tay, together with their luckless advocate, are all bundled off with the summary judgment, so happily appropriate to its own author, "I attach no value whatever to a theory which passes over and ignores this class of facts altogether."

The dogmatic assertions which the Duke of Argyll makes regarding the influence of granite and other rocks upon the surface, and as to the existence of fractures and depressions along the line of valley and glen, are really most flagrant examples of the *petitio principii*. In effect, his Grace tells us, "The 'inventions and imaginations' of these younger men are based upon 'assumed facts' which 'are, in my opinion, to a large extent purely hypothetical.' I am 'suspicious of the influence which a preconceived theory has had on their estimate of evidence.' I therefore 'attach no value whatever' to their statements, and do not consider it necessary to lose time in weighing what they actually mean by this denudation of theirs, and all which, as they contend, must flow from it. My belief is that valleys are due to fractures and depressions. The Highlands abound in valleys, and therefore it must be evident to everyone capable of forming an opinion on the subject, that they abound also in proofs of fracture and depression."

In the foregoing remarks I have been dealing only with the Duke of Argyll's paper of February 1868, which in his recent vigorously-worded address he cites as still unanswered, and which, therefore, we may suppose still to express his views. And yet no one can peruse that address without perceiving that it betokens a considerable change of opinion. Especially gratifying must it be to that "younger school" of geologists against which the Duke has so vehemently lifted up his protest, to observe that the lapse of time which he would not allow to have had much denuding effect upon the rocks, has yet been able to strip off from himself some of that crust of preconceived "theory" against which no argument or adverse fact could once make any impression. It is true

* Opening Address to the Edinburgh Geological Society, by Prof. Geikie, F.R.S. (continued from p. 91).

that his Grace formerly thought it necessary to assure us that Time could do nothing by itself, "nothing except by the aid of its great ally Force—Force working in Time." Well, we shall not quarrel about the use of words, but cheerfully admit that the change which has become perceptible in the opinions of the Duke of Argyll is wholly the result of "Force working in Time," and not a very long time, for it cannot be stretched out beyond five years. Surely if the lapse of so brief a space, with all the amount of Force which we can crowd into it, can have modified geological opinions which certainly seemed as solidly and unalterably fixed as his own Ben More itself, it can hardly be too much to hold that by the end of another *lustrum* still further modification may justify the confident belief that his Grace may still come to join the "younger school" heart and hand. We can assure him a jubilant welcome.

But it may be asked what is the nature of this present alteration of view? In brief, it may be put thus: the Duke of Argyll finds that, after all, denudation is one of those disagreeable facts which will insist on being prominent—"chiels that winna ding." He has discovered that it really has had some share in the shaping of the present outlines of the land. He now admits in words "that the forms of hill and valley which preceded the coming-on of glacial conditions [during the Ice age] had been themselves determined in a large degree by previous denudations." And even though this general admission is neutralised by statements which follow it, it is most welcome as an indication doubtless of the effect of those "more extended opportunities of observation" which his Grace tells us he has since enjoyed, and on the continuance of which our hopes of his secession to the ranks of the "younger school" are mainly based.

The Duke of Argyll appeals once more to the details of geological structure. Most gladly do we accede to the appeal. He points to the contorted condition of the older rocks as evidence of the extent to which they have been affected by subterranean movements. But no geologists are more familiar with these facts than his maligned "younger school." He conceives that it was after such movements that the forces of denudation began to work. Most assuredly; this has been explained over and over again. He affirms that "so long as such hills and mountains last at all, and wherever they are exposed to view, they bear upon them the unmistakeable impress of their origin and of the mighty subterranean forces to which their structure is due." This sentence is rather ambiguous. If it means that contorted rocks retain evidence of contortion, such an obvious truism was hardly worth a sentence to itself. If it means that a mountain made of contorted rocks has had its form determined at the time of contortion, the statement is mere assertion and a begging of the very question to be proved.

In the same address the noble president declares that "denudation has done its work along the lines determined by upheaval, by fracture, and by unequal subsidence." This has never been denied by anyone. A main object of my book was to show how, by means of denudation along such lines, much of the present contour of Scotland has been produced. Again we are told—"All sedimentary beds must have had an edge somewhere; and if they are lifted into a vertical position and the edges come to be exposed, the removal of a small amount of material may result in a horizontal surface, or in surfaces cutting across the lines of structure at every variety of angle." If the Duke intends this explanation to apply not to a mere hand specimen, but to any district of convoluted and vertical rocks, such as the hills of Wales or the Southern Uplands or Highlands of Scotland, he cannot have noticed the string of physical absurdities which it involves. The rocks are often vertical, or nearly so, for miles at a stretch. Could we put them into something like their original horizontal or gently inclined position their present edges would end off in a cliff many miles high. Can his Grace expect anyone to believe that the beds, which certainly "must have had an edge somewhere," ever ended off in that fashion? But this would be only a part of the feat. In actual fact the rocks have been violently contorted, so that a series several hundreds or even thousands of feet in thickness is folded again and again upon itself. The present surface has been cut across these foldings, and in great part has its inequalities independent of them. If we could flatten these curved rocks out again from their present condition they would show a series of deep sharp troughs separated by steep pyramidal ridges of flat strata. And from the Duke of Argyll's teaching we should learn that this wonderful arrangement was the normal plan in old times of laying down sediment which, instead of always going to the bottom and filling up the hollows as it does nowadays, contrived then to ascend, layer after layer, like the tiers of the Great Pyramid, as if it were under the impulse not of mere gravity or of the play of ocean currents, but of the methodical action of organisms like the coral polyps. We should further learn that these neatly-shaped sand and mud ridges and troughs were so accurately laid down that when subterranean forces came into action and crumpled the whole up, every ridge popped conveniently into a trough below, as if a trap-door had been opened for its reception, and with such nice adjustment as to bring its top to the same general level as the bottom of the former troughs!

The truth is, and, in common fairness I am bound frankly to state it, that such assertions as these with which I am dealing, could never be made if geological structure were really understood and kept in view. This is a matter of science, and is only to be mastered by the same patient toil which is required in other scientific inquiries. Moreover, it is by no means so easily mastered as it seems to be. The first absolute requisite for overcoming our ignorance, is to reduce our facts to the test of ocular proof and measurement. Let us construct a section across the tract of which we would master the structure, and to avoid risks of error from exaggeration of proportion, let us begin by making the section as nearly as possible on a true scale, that is, giving the same value to length as to height. With the outline of the ground accurately traced we may then, section in hand, insert upon it at the proper places, and with the true angle of dip, such rocks as we be able to see exposed. Having fixed these data in this patient way, we may expect with some confidence to understand and fill in the geological structure of the ground for ourselves, and to make it intelligible and credible to others. Until we have gone through such a training ourselves, or have learnt adequately to appreciate what it is from the labours of others, we have no right to utter an opinion on the relations between geological structure and external form, for we are destitute of one of the necessary qualifications for dealing with the problem.

The greater part of the recent address of the president of the Geological Society deals with the traces of ice-action in this country, and the manner in which they are to be accounted for. In his remarks upon this subject, the Duke again places himself in opposition to the views of the "younger school," and expresses opinions from which every member of that school would, I am sure, emphatically dissent. It is no part of my present purpose to enter upon these. I cannot, however, pass by one statement in the address. His Grace asserts that these restless "younger geologists" have recently made a most complete change of front. He therefore directs his attack against this new position. He says that they no longer maintain the existing systems of hill and valley to have been cut out of the solid by an enormous glacier, but admit the general contour of the country to have been very much the same before the Ice age as after it, all the work of the ice having been to deepen valleys, degrade hills a little, and fill up the plains and hollows with clay and sand. "Such as I understand it," says the Duke, "is the new glacial theory." But surely he can have paid but scant attention to the subject if he imagines that this idea is in any sense new. I really cannot recall that the geologists of the "younger school" have for many years past held any other view than that which they are now said to have adopted only recently. If, for example, his Grace will turn to the little volume which he abused so heartily in the spring of 1868, he will find the "new view" stated as plainly there as words can express it (see page 150). And yet in this address he thinks it needful to adduce evidence to disprove that valleys have been gouged out by an universal ice-sheet—a notion which, according to his own showing, the "younger school" does not hold.

These remarks have been extended this evening beyond the length to which I had originally proposed to confine them. My excuse must lie partly in what to myself is the ever fresh charm of the subject, and partly in the desire to vindicate the fair fame of the modern Huttonian school of geology from attacks which had been in some measure called forth by writings of my own. I have again to express my regret that it was impossible to avoid an appearance of personal conflict, and I am conscious that a man who does his best to give as good as he gets in such conflict is apt to do more than he meant. I can only hope that this consciousness has kept me far within the bounds of legitimate reply.

Of one thing I feel securely confident. When the din of strife has ceased and men come to weigh opinions in the dispassionate light of history, the profound influence of the Huttonian doctrines of the present time on the future course of geology will be abundantly recognised. By their guidance it will be possible to reconstruct the physical geography of the continents, in successive ages back, perhaps into some of the earliest periods of geological history. This work indeed is already in part accomplished. But much more remains to be done before the history of the land on which we live has been wholly unravelled. This is the task to which we have set ourselves, in which we have found ample scope for enthusiasm and hard work, and out of which we trust that there will eventually come a story of permanent interest to all whose range of vision extends beyond the present condition of things, and who would fain understand what now is by the light of what once has been.

EXTERMINATION OF MARINE MAMMALIA

THROUGH the kindness of a friend, there has been placed in my hands a little book—one of the few copies in England—which though not much bigger than a pamphlet, seems to me more deserving of notice than I fear it is likely to obtain. Of its author, I may say, I know nothing. Its title is "Mammalia, Recent and Extinct; an Elementary Treatise for the use of the Public Schools of New South Wales. By A. W. Scott, M.A." It is published at Sydney by Thomas Richards, Government Printer, and bears date 1873. One's first wish on looking at it was that such a book might be wanted for the use of the Public Schools of "the old country; but it is not my object now to enlarge on this theme or even to call attention to, or pass judgment upon it from a scientific point of view—though some of the author's opinions are, if not novel, such as have not been generally received. Mr. Scott's treatise is confined to the "*Pinnata*, Seals, Dugongs, Whales," &c. and he tells us in his preface why he has so limited it:—

"Whatever information we possess upon the natural history of the finned mammals, particularly in a popular, yet scientific form, has been so scantily and unequally distributed, that in this direction a comparatively new field may be said to be open to the teacher as well as to the youthful inquirer.

"Influenced, also, by the great commercial value of several species of the pinnata, I have felt anxiously desirous to direct, without further delay, the attention, and thus possibly secure the sympathy, of readers, other than students, to the necessity of prompt legislative interference, in order to protect the oil and fur producing animals of our hemisphere against the wanton and unseasonable acts committed by unrestrained traders; and thus not only to prevent the inevitable extermination of this valuable group, but to utilise their eminently beneficial qualities into a methodical and profitable industry.

"Keeping steadily in view these two objects, whose importance, I trust, will bear me out in deviating from my original intention in the order of the issue of publication, I have endeavoured . by devoting as much space as my limits would permit to the consideration of the animals whose products are of such commercial value to man, and whose extinction would so seriously affect his interests, to point out the pressing necessity that exists for devising the means of protection for the Fur Seals and the Sperm and Right Whales of the Southern Ocean.

"To evidence what great results may be effected by considerate forethought, I refer the reader to pages 8 to 13 of this treatise [containing extracts from the excellent paper on *Otariidæ* by Messrs. Allen and Bryant (Bulletin Harvard College, ii. pp. 1–108)], where he will see that, under the fostering care of the United States Government, the Northern Fur Seals of commerce, which but a few years ago were nearly extinct, have already, by their rapid increase and mild disposition, developed themselves into a permanent source of national wealth.

"The islands of the Southern Seas, now lying barren and waste, are not only numerous, but admirably suited for the production and management of these valuable animals, and need only the simple regulations enforced by the American Legislature to resuscitate the present state of decay of a once remunerative trade, and to bring into full vigour another important export to the many we already possess."

Mr. Scott's design appears to me eminently praiseworthy; nnd the question it raises is, without doubt, one which must imperatively demand (and will, I trust, in time) the attention not only of the naturalist, but of everyone who is interested in the commercial prosperity of this country and its colonies. Though to some extent their place has been supplied by mineral and vegetable oils, for certain purposes it is, I believe, admitted that animal oils are absolutely required, and the demand for these oils increases with the increase of civilization. Now no one who has at all closely investigated the subject of the extermination of animals by man can come to any other conclusion than that unless, by some legislative restriction (which from the nature of the case will probably have to be *international*) it is prevented, all the Marine Mammalia are inevitably doomed to early extinction. Who can read of the butcheries which are yearly perpetrated on the breeding Seals of the ice-floes in the North Atlantic, and as yearly recorded with more or less zest in the newspapers, without feeling certain that the same fate awaits them as has overtaken, or is overtaking, so many of their fellow-denizens of the deep? Where is the *Rhytina* of Behring's Island? Absolutely abolished from the face of the earth! Where are the Manatees that played in the waters of the Antilles, when those "isles of the sun" were first visited by Europeans? Limited to some three or four muddy creeks in as many of the larger islands! Where is the Right Whale that used to throng the Greenland seas, the Walrus that haunted the Gulf of St. Lawrence? Driven so far to the northward that ships in the pursuit of either are now led to encounter the greatest perils! Where is that smaller Whale which furnished employment for all the navies of Biscayan ports? You have to seek its remains in the museum at

Copenhagen! Where are the Dugongs of Rodriguez so charmingly described by Leguat? Vanished! Where are the Sea-elephants of Ascension, Tristran d'Acunha and the Crozettes? So hunted down that it is not worth a skipper's while to seek them! Where are the countless and mighty Otaries that Péron found in Bass's Straits? Not there assuredly!* The list of questions might be extended indefinitely. Surely it is time to stop such wanton, such short-sighted destruction. Let me not be misunderstood, however. No one believes more firmly than I do in the right which man has to turn animals to his *use*. It is the *abuse* of which I complain. It is an abuse of power to slaughter these creatures in such places and at such times of the year as must lead to their utter extinction; and I know there are many naturalists, some of high standing, who think with me, though perhaps their acquaintance with the facts has not been sufficient to make them see so clearly as I do that interference with the abuse must speedily be adopted or it will be too late. Naturalists, as a rule, are rare in the legislature of this country, but is there not one, at least, to call upon the Government to take the necessary steps? Granted that these steps are beset with difficulties—so much the more honour to him who surmounts them. The Russians and the Americans have been before us, and through their wise measures there is now every chance that the Seals of the Northern Pacific will continue to exist for many a long year to the great profit of all concerned.

In this matter, as in similar cases, the present generation will deservedly be reproached by posterity if we steadily shut our eyes to what has taken place and to what is going on now.

ALFRED NEWTON

* See Mr. Charles Gould's remarks in the Monthly Notices, &c., of the Royal Society of Tasmania for 1871, pp. 61–67.

NOTES

SIGNOR SCHIAPARELLI, Director of the Milan Observatory, has been appointed Director of the Florence Observatory in place of the late Signor Donati. The Florentine Observatory, which stands near Galileo's Tower at Arcetri, is in every way superior to that of Milan, and we may look for considerable results from an astronomer who has already done much with small opportunities.

ON Monday evening Sir Samuel Baker met with an enthusiastic reception at the meeting of the Geographical Society, from a large, distinguished, and brilliant audience, which included the Prince of Wales and the Duke of Edinburgh. Sir Samuel spoke mainly of what he had done to suppress the slave-trade, and of the almost overwhelming difficulties he and his brave wife had to face in bringing the lawless African tribes to reason. After Sir Samuel sat down, the Prince of Wales said a few words, and testified to the sincerity of the Khedive.

IN his address at the opening meeting of the Newcastle-on-Tyne Chemical Society, the president, Dr. Lunge, spoke of his visit to the Vienna Exhibition, and of the rapid progress which the Continent is making in the manufacture of the finer chemicals. The reason, he says, is not far to seek. "You find in every chemical works on the Continent, I may say, without exception, one, sometimes several, chemists of thoroughly scientific training, who have acquired their theoretical basis by three or four years' studying at a University or a Polytechnical Institution. One "works," to which I have already alluded, certainly one of the largest in Germany, keeps something like half-a-dozen such chemists (not practical managers), with salaries varying from 300*l*. to 400*l*., and it retains the services of an accomplished chemist, of scientific reputation, at a salary of nearly 2,000*l*. per annum, exclusively for theoretical work in the laboratory, without any trouble or responsibility connected with the manufacturing work outside. But then, they *do* constantly invent new things there, and make them in tons, or hundreds of tons, when the chemical world outside has, perhaps, barely heard of the discovery of a new compound, with a barbarous name, apparently only obtainable at the rate of a few grains in a sealed tube after many weeks' patient work. What I maintain, after a visit to the Vienna Exhibition, and at a few German and Austrian chemical works, is, that foreign countries are taking the wind out of our sails very fast in this line, and that both their rate of progress and the means of attaining it are very much superior to ours."

A PRELIMINARY meeting was held on November 29 in the Physical Laboratory of the Science Schools, South Kensington, to consider the formation of a Physical Society. The chair was taken by Dr. J. H. Gladstone, F.R.S. Thirty-six gentlemen were present, including most of the physicists of London. It was resolved that the following gentlemen be requested to serve as an organising committee:—W. G. Adams, E. Atkinson, W. Crookes, A. Dupré, G. C. Foster, J. H. Gladstone, T. M. Goodeve, F Guthrie, O. Henrici, B. Loewy, Dr. Mills, A. W. Reinold, and H. Sprengel. A letter was read from the Lords of the Committee of Council on Education, granting the use of the Physical Laboratory and apparatus at the Science Schools, South Kensington, for the purposes of the Society.

THE *Photographic News* says that a curious and important discovery has been made by Dr. Vogel during the last few weeks. It consists, as he describes it in a private letter, in making the non-actinic rays under certain circumstances actinic. "I have found," he says, "that bodies which absorb the yellow ray of the spectrum make bromide of silver sensitive to the yellow rays. In like manner I find bodies which absorb the red ray of the spectrum make bromide of silver sensitive to the red rays. For example, by the addition of *corallin*—which absorbs the yellow ray—to a bromide of silver film it becomes as sensitive to the yellow ray as to the blue ray." This is one of the most important and interesting observations in connection with actino-chemistry which has been made for several years.

AN examination will be held at Queen's College, Oxford, on April 14, 1874, and following days, for the purpose of filling up four open scholarships of the yearly value of 90*l*. tenable for five years. Candidates must not have attained the age of 20 years. One of the open scholarships will be awarded for mathematics and one for natural science in case competent candidates offer themselves. Candidates offering in natural science should be proficient in either physics, chemistry, or physiology, and possess some acquaintance with a second physical science. These candidates are requested to signify by letter to the Provost, as early as may be in March, their intention of standing, and to state at the same time the subjects they propose to offer, in order that the necessary arrangements may be made for their examination. Candidates are to call on the Provost in the College-hall at 9 P.M. on Monday, April 13, bringing with them satisfactory evidence of date and (where necessary) place of birth, and testimonials of good conduct from their schoolmasters or tutors.

THE following alterations have been made in the programme of lectures at the Royal Institution:—In consequence of Prof. Tyndall's desire to give six lectures on the Physical Properties of Gases and Liquids on Tuesdays before Easter, Prof. Rutherford will give five lectures on Respiration before Easter, and six lectures on the Nervous System after Easter. At the Friday evening meeting, March 6, Sir Samuel Baker will lecture on the Suppression of the Slave Trade of the White Nile. Dr. Burdon-Sanderson will lecture after Easter.

MR. HENRY LEE reports the development of a new calcareous sponge in the Brighton Aquarium. In its early condition it closely resembles, in its mode of growth, *Leucosolenia botryoides*, but afterwards, in some instances, becomes massive and semiglobose. It has been submitted for examination to Dr. Bowerbank, who describes it as follows :—" In the young state, a congeries of thin fistulæ, like a *Leucosolenia ;* when adult massive; furnished with numerous thin conical or cylindrical cloacal organs, very variable in size and length. Surface of the mass mooth and even; small cloacæ furnished with numerous long, slender, acerate, external defensive spicula, projected ascendingly at small angles to the surface; large cloacæ nearly destitute of external defensive spicula, furnished with a few long, slender, acerate, procumbent spicula; internal defensive spicula of cloacæ spiculated, equi-angular, tri-radiate; spicular ray, slender and attenuated. Oscula minute, distributed on the inner surfaces of the cloacæ. Pores unknown. Dermal membrane pellucid aspiculous. Skeleton spicula, equi-angulated and rectangulated, triradiate; radii slender and unequal in length, distorted; colour, cream white. Habitat, Brighton Aquarium, Henry Lee. Examined in the dried state." This sponge will be figured in three several conditions of its development, in the forthcoming third volume of Dr. Bowerbank's valuable monograph of the British *Spongiadæ*, published by the Ray Society, and will be known as *Leuconia Somesii*; Dr. Bowerbank having named it after Mr. Somes, the chairman of the Brighton Aquarium Company.

A CORRESPONDENT of the *Scotsman* points out how desirable a thing it is that a marine aquarium should be erected in Edinburgh. "The city," he rightly says, "abounds in educational establishments, to which such an institution would be an invaluable accessory. Great local facilities exist for the creation of an aquarium, and were a scheme for that purpose but set on foot, many willing hands would aid in its realisation. The cost would not be great, considering the advantages to be obtained; and it is certain the establishment would be self-supporting." We hope to see the matter earnestly taken up by proper hands.

THE fifth part of the illustrated work on Lepidoptera, domestic and foreign, by Mr. Herman Strecker, of Reading, Pennsylvania, has made its appearance. In the present part the illustrations relate entirely to the genus *Catocala*, of which one supposed new species is presented under the name of *C. perplexa*, from the vicinity of Brooklyn. Mr. Strecker merits particular commendation from the fact that this work is prepared exclusively by his own hand, the illustrations being drawn on stone, printed, and coloured by himself—and, if we mistake not, the type of the text is set up by him likewise—all done in the intervals of his daily labour as a mechanic. The expense of the work—fifty cents per number— is such a mere trifle that we trust he will be encouraged by a sufficient subscription list to continue it to completion, increasing the number of plates, as he promises to do, without any change in the price, should he receive the desired patronage.

THE London Association of Correctors of the Press held a *conversazione* on Saturday last under the presidency of Mr. B. H. Cowper, editor of the *Queen*. We are glad to notice that the principal items of the programme were of a scientific character. Mr. E. R. Johnson, Chairman of the Association, read a paper on the past work of the Association, enumerating some of the papers and discussions on philological topics which had engaged its attention, and while commending the study of philology, the advantage of an acquaintance with one or other of the exact sciences was set forth. Mr. G. Chaloner, late Secretary of the Association, and lecturer on Chemistry at the Birkbeck Institution, enlightened the meeting as to some of the properties of hydrogen, accompanying his remarks with appropriate experiments. Mr. J. T. Young discoursed on the glacial period, and exhibited some fossils illustrative thereof. The wonders of the microscope and stereoscope also contributed to the enjoyment of the evening.

THE two scientific papers in the last number of the *Quarterly Journal of the Meteorological Society* are :—" On some Results of Temperature Observations at Durham," by Mr. J. J. Plummer; and "Notes on the Connection between Colliery Explosions and Weather in the year 1871," by Messrs. R. H. Scott, F.R.S., and W. Galloway. The subject of the latter article is of the greatest importance to miners, and, in connection with it, we would call attention to a letter in yesterday's *Times* warning colliery managers of the present high reading of the barometer. We are glad to see from the Report of the Council that the Society has attained an exceedingly prosperous and altogether satisfactory condition.

NO. XI. of Petermann's *Mittheilungen*, contains a brief letter from Dr. Richard v. Drasche, concerning his geological voyage to Spitzbergen in July and August last. The letter contains a few very valuable details as to the physical and geological characteristics of the west coast of the island.

SIR GEORGE ROSE, F.R.S., died at Brighton on the 3rd inst. in the 92nd year of his age.

DR. SPEIER, of Fulda, has been appointed by the Japanese Government as Professor of Natural Sciences at Yeddo. A very handsome salary has been guaranteed to him by the Japanese Embassy at Berlin. Other appointments are expected to follow in the departments of Experimental Physics and Medicine.

Apropos of the letter in this week's number on the British Museum, we take the following from an article in a recent number of *Iron* on "Our National Museums :"—As at present constituted, Museums may be broadly divided into three types: first, that of the South Kensington, Jermyn Street, and Bethnal Green Museums in London, and the Albert Museum in Exeter,—a type of the actually useful museum, where the artisan may see illustrations of manufacturing operations, and the artist may find examples of the masterpieces of old. Here everything is neat, orderly, and simple; no object is without a label, which explains clearly what it is; and spectators need not wander about among collections of incomprehensible curiosities, which excite in their minds wonder but no interest. The second type is that of the British Museum, which is purely scientific. Museums like this are scattered over the country, containing vast numbers of useful specimens buried in drawers and cases, adorned with Latin labels; museums wherein the populace rove about with awe, partly at the monstrous objects displayed to their gaze and partly at the tremendous names which they bear. These museums are only fitted for scientific persons; they are next to useless to others, unless, as has been lately done in the British and Ipswich Museums, superintendents and curators are willing to descend from their high level and escort bodies of the simpler folk through the collections, giving as they go some plain account of the more prominent objects. A third type of museum is scarcely to be found in any national collection. It is usually seen in small country towns, where dusty cases are arranged in ill-lighted rooms, and are made the receptacle of rubbish brought by resident gentlemen from all parts of the world—one giving a collection of minerals for which he has not room; another a few drawers of butterflies of which he has grown tired. South Sea islanders' weapons, elephants' tusks, and other spoils of the chase are scattered about in corners and on walls, and the collection of oddments is dubbed a "museum." Our readers can draw on their own experience for other details on this subject, and we are much mistaken if they do not agree with us that the energy that is expended with but little useful result on our local and national museums is almost or entirely thrown away.

THE little town of Massa Marritima (Tuscany), says the *Journal of the Society of Arts*, sets an example which would be well to be followed by many larger and better known towns, both in Italy and this country. In 1867 the municipality of Massa purchased the interesting collection of minerals, models of mining machinery, and specimens of tools used in mines in various countries from Signor Teodoro Haupt, a well-known mining engineer of Florence, together with a complete series of maps and plans of most of the mines in Tuscany. This forms the nucleus of the museum, which has since been enriched by a collection of the birds and animals found in the province, the donation of a medical man residing in the town, and their value is considerably enhanced by being well arranged and tabled with both common and scientific names. The library now contains about 6,000 volumes, some of which are of great value, as being extremely rare, and relating to the history of the republic of which Massa was once the capital. The archæological department contains a very beautiful Etruscan funeral urn.

THE additions to the Zoological Society's Gardens during the past week include four Bull Frogs (*Rana mugiens*) from Nova Scotia, presented by Dr. B. Sanderson, F.R.S.; two white-handed Gibbons (*Hylobates lar*) from the Malay Peninsula, presented by Sir H. Ord, C.B.; two Griffin Vultures (*Gyps fulus*) and a Golden Eagle (*Aquila chrysaetos*), European, presented by Mr. A. J. White; two Rough-legged Buzzards (*Archibuteo lagopus*), European, presented by Mr. A. B. Hepburn; a Green Monkey (*Cercopithecus callitrichus*) from India; and a Bonnet Monkey (*Macacus radiatus*) from India, presented by Miss Bradshaw; a Barasingha Deer (*Cervus duvaucelii*) from the Himalayas, received in exchange; and a Hairy Armadillo (*Dasypus villosus*) from La Plata, deposited.

SCIENTIFIC SERIALS

Der Naturforscher, Oct. 1873.—Among the abstracted matter in this number we find an account of recent experiments by M. Exner, to determine the "reaction time" of the sensorium. Some part of the body having been stimulated, the person immediately made a signal by pressing a key with the right hand. Marks were produced on a blackened cylinder, both at stimulation and at signalling, and the interval was noted. The reaction time (which ranged between 0·1295 and 0·3576 sec. in 7 persons) seems independent of age, and is shortest in those who have the habit of concentration. The tables also show it to have been shortest in stimulation of the eye with an induction shock; then follow, in order, electric shock to finger of left hand, sudden sound, electric shock to forehead, shock to right-hand finger, sight of an electric spark; and lastly, shock to toes of left foot. M. Exner analyses the reaction time into 7 "moments."—In chemistry we have some important observations on the non-luminous flame of the Bunsen burner, by M. Blochmann, and on vinegar-ferment and its cause, by MM. Mayer and Knierim, who think the action of mycoderma aceti probably physiological, and that it is a kind of bacterium which shows a mobile and an immobile state; the latter producing rapid acetification. Further, the vinegar-production occurs without the presence of nitrogenous substances, though less slowly than where they are present.—An interesting question in plant-geography is that as to the transport of seeds by ocean-currents, and in other ways independent of human agency. M. Thuret has been experimenting on this in Antibes. Having tried 251 different species, he knows of only two kinds of bare seed which are capable of floating, Maurandia and Phormium. A long immersion in sea-water does not always destroy the vitality of seeds. Out of 24 species immersed more than a year, at least 3 germinated afterwards as vigorously as seeds kept quite dry.—We find astronomical notes on the spectra of the two new comets, III. and IV., of 1873, and on the connection of solar protuberances with auroras (Tacchini); and in meteorology there is a notice of Dr. Koppen's valuable researches on an eleven years' period of temperature.—In physics, the subjects are: short galvanic currents and electrical discharges (Edlund), armatures of magnetic bundles (Jamin), and molecular rotatory power of vinous acid and its salts (Landolt).—A review of Häckel's *Die Kalkschwämme*, by M. v. Martens, is worthy of notice.

SOCIETIES AND ACADEMIES

LONDON

Zoological Society, Dec. 2.—Dr. A. Günther, F.R.S. vice-president, in the chair. A communication was read from Dr. James Hector, containing an account of the complete skeleton of *Cnemiornis calcitrans*, Owen, and showing its affinity to the Natatores.—Prof. Owen, F.R.S., read a paper containing a restoration of the skeleton of *Cnemiornis calcitrans*, Owen, with remarks on its affinities to the Lamellirostral group, and forming the twentieth part of his series of memoirs of extinct birds of the genus *Dinornis* and its allies.—A communication was read from Mr. W. H. Hudson, containing an account of the habits of the Pipit (*Anthus correndera*) of the Argentine Republic.—A communication was read from Mr. A. G. Butler, containing a revision of the species of the genus *Protogonius*.—A communication was read from Dr. J. E. Gray, F.R.S., on the skulls of some seals from Japan, with description of a new species, proposed to be called *Eumetopias elongata*.—Mr. P. L. Sclater read a paper on some birds collected in Peru by Mr. H. Whitely, being the seventh of the series of articles upon this subject.—A communication was read from Mr. Henry Whitely, containing additional notes on humming-birds collected in High Peru.—A communication was read from Mr. R. Swinhoe, containing remarks on the Black Albatross with flesh-coloured bill, of the China Seas.—Mr. Garrod read a paper on the visceral anatomy of the Ground Rat (*Aulacodus swinderianus*).

Linnean Society, Dec. 4.—Mr. G. Bentham, president, in the chair.—Revision of the genera and species of Tulipeæ, by Mr. J. G. Baker. In this tribe of Liliaceæ the author includes the caulescent capsular genera with distinct perianth-segments and leafy stems bulbous at the base, viz., Fritillaria, Tulipa, Lilium, Calochortus, Erythronium, and Lloydia. The characters presented by the different orders were described *seriatim* in the paper. In the structure of the underground stems there are four leading types, viz., (1) a squamose perennial bulb, consisting, when mature, of a large number of thin flat scales tightly pressed against one another, and arranged spirally round a central axis which is not produced either vertically or horizontally, as exemplified in all the Old-world species of Lilium; (2) in most of the species of *Fritillaria* we have a pair only of hemispherical scales, half as thick as broad, pressed against the base of the flower-stem, these scales being the bases of single leaves which die down before the flower-stem is produced; (3) an annual laminated truncated bulb occurs generally in *Tulipa*, *Calochortus*, and *Eu-Lloydia*; (4) in the section *Gageopsis* of *Lloydia* we have a truncated corm. The leaves are very uniform throughout the tribe, with the exception of a section of *Lilium*, *Cardiocrinum*, with long clasping petioles. The perianth leaves are all coloured except in *Calochortus*, when the three outer segments are sepaloid and lengthened into points. The stamens are always six in number and nearly equal in length, hypogynous, and the dehiscence of the anther never properly introrse, but lateral, exactly as in *Colchicum*. In the capsule, *Calochortus* differs from the other genera in its septicidal dehiscence. As regards the connection between Liliaciæ and Colchicaceæ Mr. Baker is disposed to lay less stress than before on the evidence of any sharp line of demarcation between the orders, all the characters usually ascribed to the latter order being found in some of the genera of Liliaceæ. In its Geographical Distribution the tribe is spread throughout the north temperate zone; only one species, *Lloydia serotina*, is really boreal and Alpine; the southern limits are Mexico, the Philippines, South China, the Neilgherries, and the southern borders of the Mediterranean; the principal concentration of species is in California and Japan; nearly all are hardy in this climate. Lilium with 46, and Fritillaria with 55 species, have the distribution of the tribe; the latter stopping eastwards at the Rocky Mountains, while the former reaches the Atlantic sea-board; Tulipa, with 48 species, is restricted to the Old World, reaching from Spain, Britain, and Scandinavia to Japan and the Himalayas; Calochortus, with 21 species, is confined to Mexico and the west side of the Rocky Mountains; of the 5 species of Erythronium, 1 is confined to the Old World and 4 to the New; the 3 species of Gageopsis are Oriental and Siberian; while *Lloydia serotina* is the most widely spread of all the Liliacieæ, and a unique instance of a petaloid Monocotyledon of the North Temperate Zone with almost universal high mountains and Arctic distribution.

Chemical Society, Dec. 4.—Dr. Frankland, F.R.S., vice-president, in the chair.—A paper entitled Mineralogical Notices, by Prof. Story-Maskelyne and Dr. W Flight, was read by the former, treating of the composition of caledonite and lanarkite.—Mr. John Williams then exhibited some fine specimens of crystallised phosphorous acid and metallic phosphites, and gave a short account of their reactions.—Prof. Church made a communication to the society on the composition of the mineral autunite.—Prof. Lawrence Smith of the United States, whilst describing a modification of the Bunsen gas burner employed by him for heating the crucible in determina ions of the alkalis in silicious minerals, gave a short sketch of the process he had devised for that purpose.—In the course of the evening a gas burner by Mr. Fletcher of Warrington was also exhibited.

Royal Microscopical Society, Dec. 3.—Chas. Brooke, F.R.S., president, in the chair.—The list of donations to the society included a valuable binocular microscope with apparatus complete, from Mr. Charles Woodward, for which the special thanks of the meeting were returned.—A paper in continuance of the one read at the November meeting, was read by the secretary.—On some further researches into the life history of the Monads, by Rev. W. H. Dallinger and Dr. Drysdale, in which the complete process of fission was described in all its stages, and also the conjunction of two or more bodies, the whole course of internal division, of final rupture of the containing envelope and escape of minute free organisms.—Mr. Charles Stewart exhibited a section of *Ficus elastica* showing cystoliths, described the method of preparation and mounting, and stated it to be his belief that they were rather deposits of a gum-like substance, than actual concretions.

Society of Biblical Archæology, Dec. 2.—Dr. Birch, F.S.A., president. The following papers were read:—Future Punishment of the Wicked, a Doctrine of the Assyrian Religion, by H. Fox Talbot, F.R.S.—Notes from Borneo, illustrative of Passages in Genesis, by A. M. Cameron. In this paper the author cited a Dyak tradition, that at an archaic general inundation, the ancestors of the Chinese, Malay, and Dyak had to swim for their lives; and (possibly foisted on this tradition) the Dyak preserved his weapons, and the Chinaman his books. A second tradition stated that an ancestral Dyak made a ladder to go up to heaven; unhappily one night a worm ate into the foot of the ladder and brought all down. Mr. Cameron further stated that one of the two Dyak names for the Supreme Being is Yaouah: the author refers to the similar sounding Jehovah and Yahveh of the Bible.

PHILADELPHIA

Academy of Natural Sciences, June 17.—The president, Dr. Ruschenberger, in the chair.—*Laws of Sex in Juglans nigra*.—Mr. Thomas Meehan said he had at various times during the past few years called the attention of the Academy to specimens of numerous plants which illustrated the principle that sex in plants was the result of grades of vitality; or, as it had been suggested, viability; and that this power of life was a mere matter of nutrition; the highest grades of vitality only producing the female sex. He now exhibited specimens of the common black walnut, *Juglans nigra*, which furnished excellent illustrations of what had been said on other occasions. Examining the tree at the flowering season, it would be plainly seen, by even a superficial observer, that there were grades of growing buds. The largest buds made the most vigorous shoots. These seemed to be wholly devoted to the increase of the woody system of the tree. Lower down the strong last year shoots, were buds not quite so large. These made shoots less vigorous than the other class, and bore the female flowers on their apices. Below these were numerous small weak buds, which either did not push into growth at all, or when they did bore simply the male catkins. He was fully satisfied that there is not so great expenditure of vital force on the production of male flowers as there is in female flowers.

PARIS

Academy of Sciences, Nov. 24.—M. de Quatrefages, president, in the chair.—The following papers were read:—On the development of polyps and their corals, by M. H. de Lacaze-Duthiers. The author described some results obtained by him in a cruise on board the *Narval*, off the North African coast of the Mediterranean during the summer.—Remarks on the South American fauna, with anatomical details of some of its most characteristic types, by M. P. Gervais.—Observations on the expansion of water below 4°, in relation to M. Piarron de Mondesir's note, by M. F. Hement. The author suggests that the phenomenon in question is due to a re-arrangement of the molecules of the water just as a box of pins when shaken up will occupy more room than they did when arranged in regular layers.—A long extract from a letter by M. A. Poëy was read relating to his observations of the relation between solar spots and terrestrial hurricanes. The author stated that during the last 125 years there have been 12 maximum periods of hurricanes and 10 of these correspond to sun-spot maxima and 11 periods of hurricane minima, of which 5 correspond to sun-spot minima.—Observations on the analogies which exist between the solar spots and terrestrial cyclones, by M. Marié Davy.—Note on solar and terrestrial cyclones, by M. H. de Parville.—On the discharge of electrified conductors, by M. J. Moutier.—On the variable state of electric currents, by M. P. Blaserna, an answer to M. Cazin.—Application of the phosphates of ammonium and barium to the purification of saccharine products, by M. P. Lagrange.—On the physiological and therapeutic action of hydrochlorate of amylamine, by M. Dujardin-Beaumetz. During the meeting Dr. A. W. Williamson and M. Zinin were elected Correspondents.

December 1.—M. de Quatrefages, president, in the chair.—On solar and terrestrial whirlwinds, by M. Faye. The author argued against Reye's ascending axes in the cases of these cyclones, and urged that both by theory and observation there is a down-rush about the axis.—On the conclusion of the note, General Morin made some remarks on the small eddies observed in rivers as examples of the descending current in the centre of similar vortexes.—On the directions of the vibrations in the rays refracted in uniaxial crystals, by M. Abria.—Analytical and experimental investigations of the interference of elliptical rays, by M. Croullebois.—On the return of carrier pigeons during the siege of Paris, by M. W. de Fonvielle.—On the habits of the *Phylloxera*, by M. Max. Cornu.—On a theorem of celestial mechanics, by M. F. Siacci.—Note on magnetism, by M. A. Trève.—On the difference of physiological action caused by induced currents from coils formed of different metals, by M. Onimus. The author stated that, with a coil made of a badly conducting metal the contraction of the muscles was greater and the effect on the cutaneous nerves smaller than when the coil is made of a good conductor.—On the conjunctive elements of the spinal marrow, by M. L. Ranvier.—On the *Anthracotherium*, discovered at Saint Menoux by M. Bertrand, by M. Gaudry.—On the secretions of the flowers of *Eucalyptus globulus*, by M. Gimbert.

BOOKS RECEIVED

ENGLISH.—The Pearl of the Antilles: Walter Goodman (H. S. King and Co.).—The Internal Parasites of our Domesticated Animals: Dr. Spencer Cobbold (*Field* Office).—A Phrenologist among the Todas: Col. Marshall (Longmans).—The Bible and the Doctrine of Evolution: W. Woods Smyth (H. K. Lewis).—The Threshold of the Unknown Region: Clements R. Markham (Sampson Low).—Easy Introduction to Chemistry: Arthur Rigg (Rivingtons).—Chemistianity: J. C. Sellars (Author).—The Romance of Peasant Life: Francis George Heath (Cassell).—Cholera, how to Avoid and Treat it: Henry Blanc, M.D. (H. S. King & Co.).—Centrifugal Force and Gravitation, Supplement B: John Harris (Trübner & Co.).—Kant's History of Ethics. Translated by T. K. Kingsmill (Longmans).—Physical Geography in its relation to the Prevailing Winds and Currents: J. K. Laughton (J. D. Potter).—A Treatise on Medical Electricity: Dr. Althaus (Longmans).—Weather Folk-Lore: Rev. C. Swainson (Blackwood).—Ganot's Physics. Translated by Atkinson. 6th edition (Longmans).—Waste Products and Undeveloped Substances: P. L. Simmonds (Hardwicke).—Man and Apes: St. George Mivart (Hardwicke).—Body and Mind: Alex. Bain (H. S. King & Co.).—Metamorphoses of Insects: Sir John Lubbock (Macmillan & Co.).

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